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PRINCIPAL CONTENTS

The Tobacco Industry
Winter Feeding of Dairy Cows
The Progress of Herd Testing
Care of Ewes at Lambing Time
Pig Feeding Tests
Registration of Stallions — Annual Report
Tongala Irrigated Farm Competition

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THE JOURNAL

OF

THE DEPARTMENT OF AGRICULTURE

VICTORIA, AUSTRALIA.

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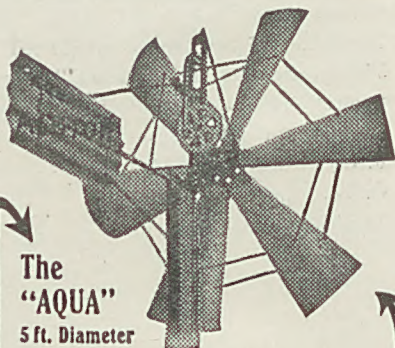
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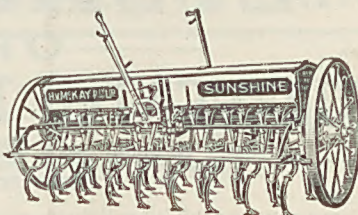
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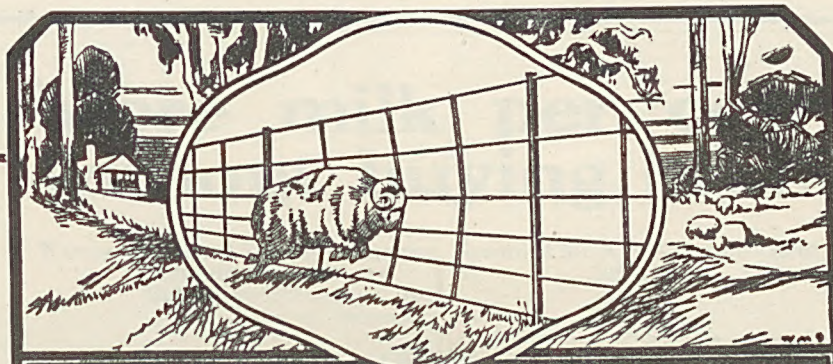
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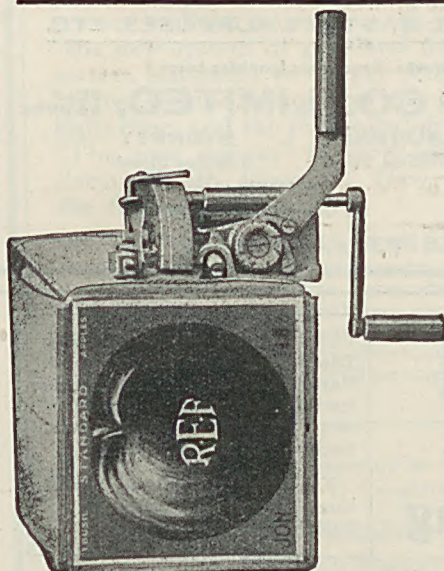
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Dam Dominion Woodnymph

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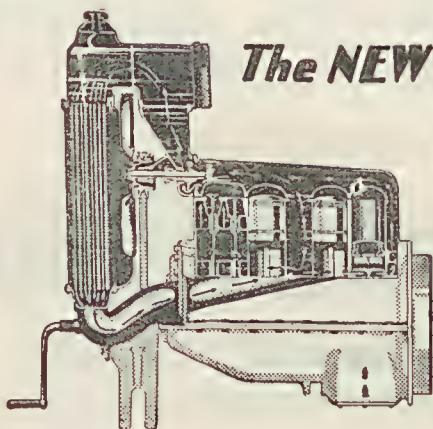
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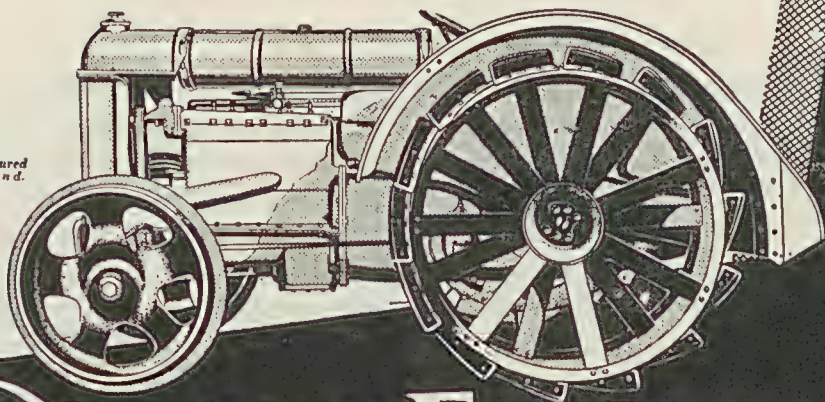
ILLUSTRATION AT LEFT—Sturdy "V" type belt from crankshaft drives the pump shaft, which also carries the radiator fan. Note the unit construction of radiator and pump housing with engine.

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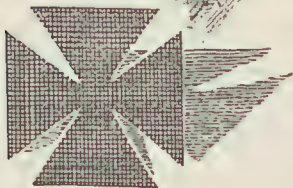
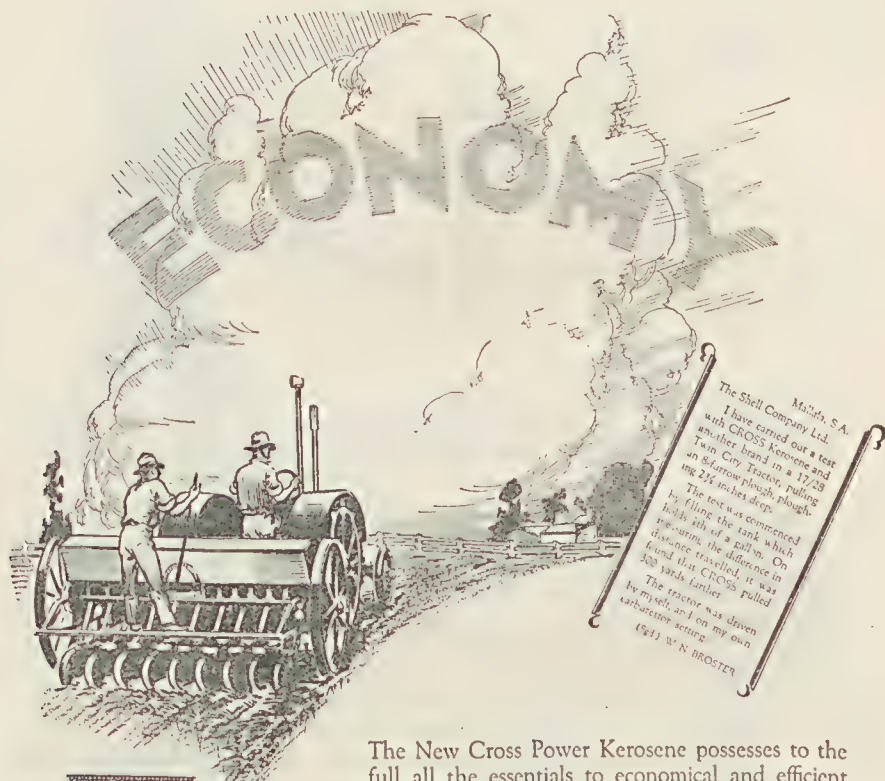
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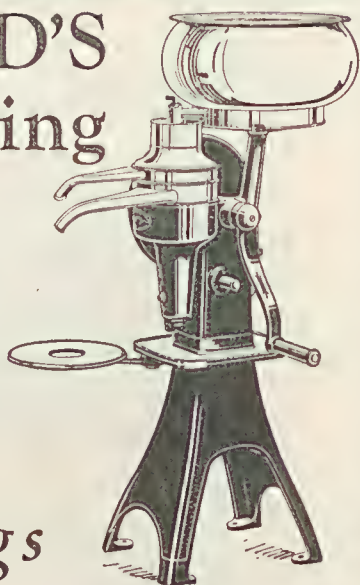
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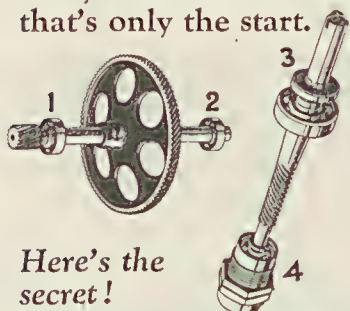
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THE JOURNAL
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Department of Agriculture
OF
VICTORIA.

Vol. XXVIII.

May, 1930.

Part 5

THE TOBACCO INDUSTRY.

Report to the Commonwealth Tobacco Investigation Committee on Observations and Enquiries relating to the Tobacco Industry in the United States of America and other countries.

By Dr. S. S. Cameron, Director of Agriculture, Victoria.

London Enquiries:—Literature; Imports in Bond; Tobacco Growing in India; African Tobacco.

American Enquiries:—Soils, Climate, and Culture for Tobacco; Essential Soil and Factors; Fertilization of Soils for Tobacco; The Scientific Aspect of Curing; Marketing of Tobacco; Processing Prior to Manufacture; Quality of Tobacco; Manufacture of Tobacco, Tobacco Plant Diseases; Conclusion.

During my visit abroad (July, 1927—January, 1928) I took advantage of such opportunities as offered to gain knowledge concerning the tobacco industry in various parts of the world.

London Enquiries.

The presence of delegates to the Imperial Agricultural Research Conference from all parts of the Empire where tobacco is grown on a commercial scale afforded a unique opportunity to learn at first hand, and in considerable detail, of the vicissitudes which had been experienced in those dominions and colonies that have won through to successful and profitable tobacco culture, notably India, Canada, and South Africa.

Literature.

Through the courtesy of Mr. F. L. Macdougall, of Australia House, Mr. Fitzpatrick, B.Sc., a technical staff officer, was detailed to assist me in the collection of such literature as was obtainable in London relating to tobacco growing in the Empire, and the officers of the British Ministry for Agriculture and the Empire Marketing Board were very helpful in this regard. Nevertheless, it was decidedly disappointing to find so little had been published in the English language on the subject of tobacco growing or tobacco leaf treatment. Bulletins and monographs published by Government Departments and Experiment Stations, and these largely relating to diseases and pests of tobacco,

constitute the only literature available. Other than one or two books, obviously written as popular expositions to interest tobacco consumers and totally devoid of scientific treatment of the subject, there does not seem to have been published, either in England or America, any reliable text-book or work of reference on any branch of the tobacco industry.

Imports in Bond.

As the guest of the Port of London authority I was privileged to spend a full and very informative day in an inspection of their tobacco bond warehouse under the guidance of Mr. Evans, manager of the tobacco sections. I met there a number of representatives of tobacco manufacturing and merchanting firms. It was interesting to learn that the consumption of Empire-grown leaf in England has risen from 1 per cent. in 1914 to 10 per cent. in 1926, largely because of the stimulus given to tobacco growing in the overseas dominions and colonies by the preference duty on Empire-grown imports. Tobacco to the amount of 40,000 tons was in those bond stores awaiting clearance by British manufacturers at their convenience. I was informed that 70,000 tons was similarly held in bond at the port of Liverpool. The imports were from all parts of the world and were readily distinguishable by the varied method of packing. That from the United States of America and Canada is stripped leaf, and was mostly packed in large hogsheads containing from 700 to 1,900 lb. (average of 900 lb.). Perique tobacco from the United States of America, black and tarry with a strong treacly smell was packed in air-tight barrels. The Florida product arrives in boxes, that from South Africa and Asia Minor (Turkish) in bales. Turkish tobacco obviously is treated and packed with meticulous care. The small leaves are graded to even size and shape, and before curing are separately stitched at the stem end on to strong thread. This threading results in perfect superimposition of leaf upon leaf when baled and the pack has a most attractive appearance. The vicinity of Latakia bales is disclosed by the strong and distinctive aroma imparted to the leaves during the fire-curing process to which the raw leaf is subjected, the fuel used being the stems of aromatic reeds.

All imported tobacco is subject to a moisture content test. Although from 1 to 14 per cent. moisture is regarded as the most desirable moisture content to maintain proper maturing action during storage, importers strive for a content as near as possible to the 10 per cent. minimum limit allowable for duty without penalty, the duty being based on weight.

The warehouse staff maintains a small museum containing samples of all varieties of tobacco imported. A study of the variable types from different countries with a wide range of latitude, soils, and climate, is interesting. It is also interesting to observe that, while tobaccos from so many countries are shown, Australian leaf is not represented.

Tobacco Growing in India.

Discussions with the Conference delegates from India disclosed that there are over 1,000,000 acres in the Indian Empire devoted to

tobacco growing. The yield varies from 160 lb. per acre under primitive methods of cultivation to 3,200 lb. per acre. Most of the tobacco grown is coarse, and is used to meet local requirements. The surplus of exports over imports is approximately 40,000,000 lb. Export figures are:—45,000,000 lb., comprising raw leaf 22,000,000, manufactured tobacco 23,000,000 lb. The imports total 5,500,000 lb., comprising raw leaf 1,250,000 lb., manufactured 4,250,000 lb. Of the manufactured imports it is interesting to note that nearly 4,000,000 lb. represents manufactured cigarettes from the United Kingdom, while only 190,000 lb. of cigarettes are imported from the United States of America. Early cultural and curing difficulties have been overcome to a considerable extent, and the matter of distinctive varieties for special types of tobacco is now being concentrated on. The Adcock variety has given excellent results and its use is extending rapidly.

A considerable amount of field experimental work and curing-shed observational work has been undertaken by the provincial Governments, but laboratory research on the chemical and physiological problems associated with production, curing, and preparation for manufacture has not been undertaken to any extent.

African Tobacco.

Discussion with Colonel Williams, delegate from the South African Union, Mr. A. J. W. Hornby, B.Sc.A.I.C., Agricultural Chemist-in-Charge of Tobacco Investigations in Nyasaland, the delegates from Rhodesia, and those other British dependencies in South and Central Africa, gave me much information relating to the progress and development of tobacco growing in these regions. Mr. Hornby, with already an extensive knowledge of the tobacco position in Africa, had, in 1926, been engaged on a most comprehensive investigation of tobacco-culture methods throughout the United States in order to make a comparison of the factors and methods prevailing in Nyasaland. His investigation related particularly to a comparison of soils and climatic conditions, the fertilization and rotation of soils, curing methods as affecting changes of leaf composition, and the chemical relation of composition to quality.

In a masterly exposition of this work, published by the Nyasaland Government, after emphasizing the full importance of soil composition and fertilizing methods as influencing the factors constituting "quality" in tobacco leaf, he states that, "It is certain that the 'twang' of certain Nyasaland tobaccos may be eliminated by different methods of curing." This statement has reference to the outcome of research on curing by Dr. W. W. Garner, of the Bureau of Plant Industry, Washington, United States of America, to whose researches on this subject reference will be made later in this report.

Probably tobacco culture in Africa has made greatest progress in Rhodesia, where, in the year 1926-27, the yield had risen to 17,420,000 lb. (17,240,000 lb. Virginia type leaf from 32,614 acres, and 180,000 lb. Turkish type from 600 acres). The increase has been enormous during the last five years, the total yield in the year 1922-23 having been only 2,810,881 lb. (Virginia, 2,540,942 lb.; Turkish, 269,839 lb.).

That the progress of tobacco culture in Rhodesia and South Africa is likely to become an important factor in the world's market, and particularly in the United Kingdom consumption, is evidenced by the

statement of the President of the Tobacco Association of the United States in a recent address. In his opinion "Rhodesia and Canada probably present the greatest possibilities as to quality, Rhodesian tobaccos competing with Virginia and Carolina growths and Canadian tobaccos with Burley and the dark tobaccos of Kentucky." He pointed out however that "though efforts to improve the leaf have met with a fair degree of success, so far as colour and texture is concerned, the flavour is not so delicate or as choice as that of American tobacco." The editor of *Tobacco*, commenting on these statements, states, "It is essentially in the matter of fermentation that the Rhodesian and South African tobacco fail at present," and he further remarks that only scientific experiment and expenditure of the necessary money is required for the successful solution of this particular aspect of the problem, in which case there would be no limits to the prospects ahead.

The above remarks, both as regards yield progress in Rhodesia, and the question of aroma and quality, suggest an analogy with the present position in Australia, and afford some indication of one line of action along which the investigations of the Tobacco Investigation might be directed with advantage.

American Enquiries.

My time during the first few days after my arrival in New York (16th November) was divided between collaborating with Sir Hugh Denison, Australian High Commission to the United States of America, on the consideration of the American applications for the position of Director of Tobacco Investigations, and discussions with the management and staff of the New York office of the British American Tobacco Company. They were kind enough to give me the opportunity for lengthy discussions, and they helped me considerably in determining on my itinerary. Our discussions principally bore upon their system of purchasing, and their methods, after purchase of the leaf from the growers, relating to grading, "re-ordering" by steam "cooking," packing, and storage. They pointed out that leaf was bought with varying percentages of moisture, and that it was necessary to re-condition or bring it into "order," so that all the leaf would be of the desirable and uniform moisture content to promote proper maturing and "sweating" of the material during the period of storage in hogsheads. This hogshead storage or "prizing" period extends over varying periods from nine (9) months to three (3) years.

During the storage in hogshead or cases "the tobacco matures and goes through 'natural sweats'" which sweetens it. If manufactured straightway after "re-ordering" it would be deficient in flavour. As manufacturers they prefer leaf stored from eighteen (18) months to two (2) years old, but nowadays the average would be something over a year. Some years back four or even five years' old tobacco was considered desirable, but the cost of capital lying idle over such lengthened periods had forced the curtailment of the "ageing" period. The "sweetening" of the leaf by sweating during storage must not be confused with the artificial "sweetening" of some blends during manufacture. It was explained that "sweetening with sauces during manufacture sweetens, but it does not change, the tobacco flavour."

It should, perhaps, be interpolated here that the sweetening of tobacco that takes place during hogshead storage is a mellowing change

produced by enzymic action or fermentation of certain organic matters in the leaf, somewhat analagous to the change in green fodder when subjected to pressure and air limitation, and which results in the production of "sweet silage" or "sour silage," according to the stage to which fermentative change of the carbohydrates is allowed to proceed.

On leaving New York (22nd November) I proceeded to Washington, D.C., where engagements had been made for me to interview other applicants for the Directorship. Mr. D. M. Dow, Official Secretary to the High Commissioner, had also kindly arranged that Dr. W. W. Garner, Chief Plant Physiologist and Officer-in-Charge of the Tobacco Investigation of the United States Bureau of Plant Industry, should be in Washington for interviews during my visit.

Dr. Garner is the foremost scientist in America on tobacco, and has directed all scientific research on tobacco problems undertaken by the United States Department of Agriculture during the last twenty (20) years. He and his assistants gave me much of their time, and we engaged in discussion on many aspects of the tobacco industry.

After my travel through Virginia and North Carolina I returned to Washington to meet Dr. Garner again for further discussion in the light of observations I had made meanwhile.

At an interview with Mr. Koener, the Director of the State Department of Agriculture at Richmond, Virginia, I was advised that it would be of little use to visit any of the field experiment stations or farms on account of it being the dead season. It is probable, however, that by concentrating on the opportunities afforded by the marketing and reconditioning season being in full swing, the most profitable use was made of the limited time I had at my disposal.

Soils, Climate, and Culture for Tobacco.

My visit to the tobacco growing districts of Virginia and South Carolina occurred at a period of the year when there was no possibility of observing the methods in operation concerning either preparation for cropping, the raising of plants, the growth and tillage, harvesting or curing the crop. I therefore had to depend on information gathered from scientists, officials, farmers, salesmen, buyers, and other members of the staffs of co-operative and joint stock firms, and of re-ordering, grading and storage houses.

An outstanding deduction to be drawn from the information received from all sources is that the varying characters and qualities of tobacco leaf by which it is classified into "types" is definitely related to the character of the soil on which it is grown, and to the climatic conditions governing its growth. Thus it is accepted that similarly constituted and fertilized soils will produce different types of tobacco capable of developing on curing varying quality, according as the climatic conditions differ. Conversely, like climatic conditions will not necessarily overcome varying quality according as the soils vary. These dicta have been arrived at by observation and experience over a long period of years, and have been verified by experiment. A study of maps showing the types of tobacco grown in the same locations in successive decades over the last 70 years reveals the many changes of location for certain types that have been forced by economic conditions. "Proof by trial" has been the process by which the present knowledge on the

matter has been reached, and, except as regards a few of the factors determining the suitability of certain soil types for the production of certain tobacco types, it would seem that proof by trial will still have to be adopted in all new areas where tobacco growing is contemplated in Australia. In other words, it does not appear that any definite key to the character of soils and climate that can be relied on to produce a required type of leaf is available by chemical, physical, or other tests.

In this connexion the recent work of Dr. Garner has, however, demonstrated the essentiality in the soils of the presence of magnesium as well as the ordinary chemical plant foods such as compounds of phosphorus, nitrogen, calcium, potassium, &c. He indicated to me the probability that the presence of the more rare minerals, such as boron, manganese, iron, and fluorine would probably be found to have a determining influence on the kind of growth contributing to the determination of "types".

Essential Soil Factors.

Other factors that, in Dr. Garner's opinion, seem to be definite in this regard are:—

That leaf texture is related to soil texture; e.g., thin leaf on sandy soils and thick leaf on heavy loams;

That sunshine and dryness of the atmosphere and soil are correlated with leaf composition that will develop aroma on curing and post-curing treatment.

That the amount of the nitrogen of the soil is reflected in the protein of the leaf (and its cleavage products) which may have to do with the development of aroma.

That soil colour is also reflected in the colour of the leaf, to wit, the Burley colour when grown on red soils and bright colour on light coloured sandy soils.

That flue cure types of leaf are only satisfactory when grown on soils with low nitrogen content, and which are sandy and "dry," i.e., low moisture-holding capacity, they also need a liberal potassic supply for physiological perfection of growth and adequate phosphorous available to promote satisfactory ripening.

That the reverse, high moisture-holding capacity ("wet" soil), is necessary for the "air cure" types such as Burley and dark mahogany.

That the potentiality for quality and high nitrogen content are in inverse ratio.

Fertilization of Soils for Tobacco.

Much experimental work leading to definite practice on the effective manuring or fertilization of soils has been done in America. Such work and the desirable fertilization methods to follow under differing circumstances and objectives are fully set out in numerous bulletins and monographs circulated from experiment farms and State and University Departments of Agriculture, and need not be discussed at any length in this memorandum. The more recent of this work has, however, demonstrated conclusively that the application of either single or compound artificial fertilizers suggested by knowledge of the chemical

and physical characters of the soil, especially as regards deficiency factors, are not necessarily effective. Similarly failure frequently results from fertilization practice based on a knowledge of the excesses or deficiencies of leaf structure constituents. Dr. Garner instanced ammonium phosphatic compound in calculated proportions with nitrate of potassium as a theoretically perfect fertilizer in certain cases which in practice utterly fails to bring about the expected result. More important is the research work which has indicated that the effectiveness of any particular constituent of a fertilizer is variable according to its source, and the combination in which it exists. This is found to be particularly the case as regards nitrogen, calcium and magnesium elements.

The Scientific Aspect of Curing.

The investigations on air cured leaf conducted under the United States Bureau of Plant Industry by Dr. W. W. Garner, Physiologist in charge of Tobacco Investigations, C. W. Bacon, Assistant Physiologist, and C. L. Foubert, Assistant in Tobacco Chemistry, have shown that the barn curing of tobacco is an entirely different process to the fermentation and ageing which tobacco undergoes after curing in the barn and before manufacture, and that these two processes which are often confused should be sharply defined. Barn curing is a process taking place while the cells of the leaf are still alive. It involves physiological changes in the organic composition of the leaf under starvation conditions. As drying proceeds there is a translocation of soluble matter from the leaf web through the veins to the midrib and on into the stalk. With this translocation death of the cells and drying of the leaf occurs. The midrib remains alive and green longest unless the leaf is being cured on the stalk, in which case the stalk becomes the repository of the translocated material, and remains green for a considerable period. It may be suggested from this work of Dr. Garner's that there is apparently an effort on the part of the drying and dying stalk to conserve the translocated food supply material in the stalk for the resuscitation of the vigour of the plant, and in some cases this is reflected in the formation of secondary shoots and suckers springing from the axile of the leaves during the period of curing on the stalk, a not uncommonly observed phenomenon.

In a series of experiments extending over a period of four years, Dr. Garner found that when the leaf was barn-cured on the stalk there was a total loss of organic matter in the leaf of 24.7 to 26 per cent., while in the case of the leaf cured after removal from the stalk the loss was from 12.2 to 13.9 per cent. only. In both methods of curing nearly all the starch disappears from the leaf, and this disappearance is so characteristic of the changes during curing that the relative freedom from starch of the cured leaf is regarded as a measure of the completeness of the curing process. The loss of nitrogenous material during curing is not so complete. In some cases it runs to 60 per cent. of the total, the average loss being 25 to 30 per cent.

The ether extract of cured tobacco leaf is a complex substance containing but a little fat or oil mixed with chlorophyll, tobacco resins, &c. The changes, if any, in these substances during curing have not been investigated.

In the case of flue-cured leaf, analyses show that the changes referred to above are similar in character, but are less complete.

As regards the effect of curing on aroma, Dr. Garner is definitely of opinion that while barn curing "materially changes the physical and chemical properties of the tobacco leaf, more particularly such properties as the capacity to hold fire, the colour, the texture, and the elasticity, it does not develop the aroma."

Marketing of Tobacco.

During visits, extending over a week, to Richmond, Virginia, and to Danville, and Winston-Salem, North Carolina, close observations were made of the marketing of barn-cured leaf as delivered by the grower. The system of marketing tobacco leaf in America has been so frequently described that submission of details will be scarcely necessary. I am strongly of opinion, however, that a system of marketing, as influencing the education of the grower on curing and grading, and, therefore, as regards the quality of his product generally, is a factor that merits as much consideration as any other that the Tobacco Investigation Committee can concern itself with.

The American system of marketing tobacco differs widely from the practice in Australia, but it closely parallels the method of marketing wool which has been developed in Australia, and which has had so marked an influence on the education of the wool grower as to the qualities of wool for manufacturers needs and the improvement of the growers methods to meet market requirements. Auction selling is the vogue. It is conducted in large open warehouses or sheds by firms of selling brokers, who function practically in the same capacity as the wool selling houses in Australia. Sales are conducted daily throughout a period of four or five months in the various towns that have become the popular selling centres. Sale days and hours are allotted to the various warehouses in a centre, and although groups of centres throughout the tobacco-growing States are in action concurrently during the sale season, buyers for all the purchasing firms are, to a large extent, able to operate at all the sales throughout the series.

The tobacco is delivered at the sales room usually the day before the sale, from farm vehicles on to large rectangular basket trays (3 ft. 6 in. x 3 ft. 6 in.). It is placed on separate trays according to the grade into which the farmer has himself graded it, so that each seller may have in his consignment half a dozen or more trays of varying quality and weight (between 30 lb. and 400 lb., sometimes higher). The weighing is done by the warehouse staff, and the trays have a numbered tag, showing the weight, skewered on to the upper layer of tobacco hands. The trays are then arranged in rows the length of the selling floor, with sufficient space between the rows to accommodate the auctioneer, buyers, sellers, helpers, and onlookers. This group passes from tray to tray by continuous movement as the auction proceeds. The selling is done very rapidly, the average time occupied in respect of three separate ranges of upwards of 50 lots each, which I checked, being 11 seconds, 13½ seconds, and 18 seconds per lot. The proceedings are without much animation, and, as it appeared to me, without much competition, there being a paucity of buyers. The purchasing by the same buyer of most of what was available of approxi-

mately similar types and grades was noticeable at the sales I attended. The view was very generally held amongst growers whom I talked with that lack of competition was due to the practice of buyers either deliberately or tacitly arranging that their particular requirements on the day should be secured without serious competition at an understood level of price. The view was subsequently supported by a highly and responsibly placed official in one of the principal tobacco-growing States. The movement for co-operative selling and handling of the tobacco crop, which had its origin in the alleged prevalence of the practice referred to, but which has not had a successful outcome, has already been very fully expounded in the report to the Committee by Dr. Darnell Smith.

With practically only one buying organization of any consequence to purchase the Australian crop, no material advantage can be expected by the adoption of auction selling at a central warehouse or depot from the standpoint of increased competition. But auctioneering need not necessarily be associated with sales at warehouse sales centres. The advantages that would accrue from warehouse selling is that growers would have the opportunity of comparison of their own product with that of other growers as regards quality and grading, make up the pack. At present the grower has no opportunity of gaining knowledge or experience on these matters from other than his own practice and its results, or those of an immediate neighbour or two. Instruction on grading and such like matters by departmental officers is also under a considerable handicap by reason of the lack of means for comparison on the farms visited. The discussions that would occur at a selling centre during the sales between growers themselves on such subjects as soil variations, differences in method of culture and curing as affecting colour, texture, aroma, yield, and the like, would be of inestimable mutual advantage. The opportunity would also be afforded of buyers demonstrating their requirements to growers in a much more satisfactory manner than can possibly be done at present.

Similarly the facilities for demonstration and instruction by experienced growers as regards the objective of their operations, would be greatly advanced.

Processing Prior to Manufacture.

"Re-ordering" and "Ageing."—The handling of tobacco subsequent to the purchase of the barn-cured leaf and prior to "manufacture" differs in America from the practice in Australia. In America there is an intermediary organization between the grower and the manufacturer which undertakes:—

- (1) the purchasing of growers graded and cured tobacco;
- (2) the grading "re-ordering" and processing for storage;
- (3) the "prizing" and storing of tobacco (usually in large hogsheads) for from 1 to 3 or more years ("ageing" period);
- (4) the sale to manufacturers in lots suitably graded and of suitable size for manufacturers requirements.

This intermediary organization comprises both independent firms who neither grow tobacco nor manufacture tobacco, but confine their operations to the above functions, and also manufacturing firms who

have a purchasing and "re-ordering" organization separate from their manufacturing concern, which does the buying and storage, &c., not only for their own manufacturing requirements but also for other manufacturing both in America and abroad. Thus the British-American Tobacco Company is the buying organization for the British Australasian Tobacco Company and its component companies, as also for other companies in Canada, England, and other countries to which American-grown leaf is exported.

After purchase at the warehouse each buyer's purchases are packed in hogshead for transport to the "prizing house." During this packing as far as possible similar types and grades of leaf are packed together. Opportunity is also taken to exercise a greater refinement in grading the types and qualities than the growers lots show.

At the re-ordering or storage warehouse the preparation for storage or ageing mentioned above is carried out. The prime object of the process originally was apparently to bring about a uniform and standard moisture content in the tobacco as purchased on the selling floor, which, of course, would vary considerably, and so result in a variable intensity and effect of the "sweating" which proceeds when the tobacco is stored in hogsheads during the "ageing" period. From the comparatively crude methods of years ago, the process has now been developed and standardized to the extent that scores of very extensive and costly buildings are in use in Richmond, Danville, Durham, and other main centres in the tobacco-growing States. These modern buildings are equipped with elaborate machinery for carrying out the perfected process, and for controlling temperatures, moisture, and ventilation throughout.

By the courtesy of the New York office of the British-American Tobacco Company, I was enabled to visit one of their "re-ordering" houses at Richmond, Virginia, and under the guidance of the manager of their Export Leaf Department, was privileged to make a detailed inspection of the "re-ordering" plant, grading methods, and the various stages of the preparation for hogshead "prizing" and storage. (The terms "prizing" relates to the screw pressure put upon each hogshead as the leaf is being packed to obtain the requisite degree of compactness of the contents in relation to its moisture whereby the desired semi-annual "sweats" may be promoted during the "ageing" period).

Grading.—Prior to the "re-ordering" process being commenced, the tobacco received in hogsheads from the selling floors is subject to very carefully conducted grading into numerous grades of uniform colour, texture, &c. This work is done by negroes and negresses, with whites overseeing their work and instructing them. Each "hand" of tobacco is untied, and the individual leaves composing it are straightened out and judged one by one as to grade they are suitable for. In grading, the senses of sight and touch (handling) are apparently mainly relied on. I did not observe either in the salesroom or the grading floors the use of the sense of smell. Aroma is apparently not given any special consideration in the grading of the raw leaf (i.e., cured leaf).

Drying, Sterilization, and Reconditioning for Moisture.—As the grading proceeds, the graded leaf is strung on sticks for transfer to the travelling belt of the reconditioning chambers. These chambers consist of long compartments or ovens through which the tobacco passes

suspended on the sticks which are hung by their ends on the slots of a travelling chain belt operated by ratchet mechanism. In the first series of ovens the tobacco passes through dry air regulated by fan blasts, and maintained at an increasing temperature, higher as each oven is passed through. The temperature of the air in the first compartment is maintained at about 100 deg. F., but arises in successive compartments to as much as 200 deg. F. The effect is the gradual drying of the slowly moving leaf, and its sterilization, moulds, bacteria and such like organisms being destroyed by the dessication and high temperature to which they are subjected. On leaving the hot air ovens the tobacco is rapidly cooled by being passed through a low temperature chamber. At this stage the tobacco is sterile, dry, and brittle, and it is necessary to recondition it to the desirable moisture content for storage and "sweating." From 11 per cent. to 13 per cent. moisture is found to be the most suitable to produce the desired "sweat" when tobacco of such moisture is "prized" in hogsheads to the requisite compactness.

This "re-ordering" of the moisture content is effected by passing the tobacco (still on the conveyer belts) to a steam chamber, into which a regulated flow of steam is admitted at a rate that allows of the requisite absorption by the tobacco to ensure the desired moisture content. At various stages of the journey of the tobacco through the chambers, which occupies about one hour, provision is made for checking the conditions inside the chamber by means of inspection openings, thermometers, and gauges.

"*Storing*" and "*Ageing*."—On emerging from the steam chamber the tobacco is removed from the sticks and packed methodically in hogshead, and prized by means of a screw press, the process being much the same as that of the familiar Australian wool press.

The hogsheads are wheeled to a storage room where they remain for a varying period—not less than nine months, and not more nowadays than three years. The huge amount of capital kept idle which was involved in the four or five years "ageing" in vogue some years ago, militated against the continuance of the practice, and it is only when some special object is to be achieved that tobacco is now aged for more than three years. I was told that the basis of the first manufacture of the recently introduced "Old Gold" cigarettes was a line of many thousands of tons of one particular grade of Virginia type tobacco which has been "aged" for upwards of four years.

American importers of Turkish tobacco, on which a high duty is paid now, import the raw or air-cured leaf from Asia Minor in order that they may themselves control the "ageing" process, and ensure the full uniform development of fragrance. With such expensive raw material no risk is taken as regards obtaining the full advantage of "ageing," and imported Turkish tobacco is, therefore, stored for "ageing," usually for three and four years, but never less than two years. This storage is usually in bond, so that payment of the duty may be deferred until the tobacco is required for manufacture. Proper packing for storage in bond is ensured by representatives of importing firms resident in the country of origin supervising the packing after purchase.

It will be readily recognized by those familiar with the manufacture of perishable products, such as milk, cream, fruit, &c., that the process of "re-ordering" tobacco which I have described bears some similarity to the process of "pasteurization" as applied to such manufacture. It involves alike the subjection of the material being treated to a bactericidal temperature sufficiently long to destroy all but the most persistent spore bearers, followed by rapid cooling to inhibit the development of adventitious infection.

Earlier in this report I have referred to the all-round acceptance of the view that soil and climate are responsible for a very definite influence on the quality of tobacco. The equally universal recognition of the prime importance of "ageing" tobacco under the strictly governed conditions I have described, and involving as it does such a high cost, forces the conclusion that at least equal prominence must be given to this procedure as an influence on the ultimate quality of the manufactured product as is attributed to soil and climate. It is a stage or phase of the tobacco industry clearly recognized in America as essential to successful tobacco manufacture, and in the interests of the tobacco industry in Australia it is incumbent to know to what extent the care that is devoted to it in America is exercised in respect of Australian-grown tobacco.

Quality in Tobacco—Aroma, Colour, Texture, &c.

Aroma.—Previous reference has been made to the fact that in the grading of tobacco prior to re-ordering, I did not observe any attention being given to aroma in determining on the grade. The views expressed by manufacturing experts whom I interviewed indicated a consensus of opinion that aroma and flavour changes are developed during the period the tobacco is subject to the spring and fall "sweats." Reference has also been made to Dr. Garner's conviction that "barn curing does not develop aroma."

Dr. Garner frankly admits that there has been no acceptable outcome of any scientific investigations that have been made into the origin or process of development of aroma. Other scientists agree on this, and there is not unanimity of opinion even as to what component of tobacco leaf aroma is developed from; whether from the resinous or gum compounds, the alkaloids including nicotine, the proteins or their cleavage bodies, the carbohydrates or their derivatives, the fats or mineral matter, is still the query. Certain it is that the wherewithal for the ultimate elaboration of aroma, whether good, bad, or neutral is materialized in the plant during growth, and the indications are that the development of aroma from this wherewithal occurs at some stage during the curing or processing for manufacture, and also that the character of the aroma so developed may be influenced for good or bad during such development.

It seems to be almost axiomatic in the trade that, given leaf of a certain texture and "quality," the desired aroma will develop during ageing. The particular degree and character of such developed aroma is held to depend on the climatic and soil conditions which prevailed during growth. Mild and agreeable aroma is regarded as being associated with dryness of soil and of atmosphere during the growth of the plant. Thus, sandy soils and sunshine promote the growth that gives

the texture of leaf associated with good aroma, or as is the case with Maryland leaf and Sumatra wrapper leaf with neutral aroma or absence of aroma. Conversely, strong, heavy and undesirable aroma develops in heavy textured leaf grown on heavy moisture-holding soils, and in a humid atmosphere. Hence, tropical tobacco usually develops strong and unpleasant aroma, although there is the paradox afforded by Sumatra wrapper leaf being grown in a humid climate, yet possessing great value for cigar wrappers on account of the fineness of texture and neutrality or absence of aroma.

So it comes about that the tobacco from certain districts or "belts" are depended on by the trade to possess, when matured or "aged" the requisite characters of aroma, combustibility (holding fire), and the like, to render it suitable, when blended in proper proportions, for the manufacture of the cigar and pipe or cigarette tobaccos which the consumer wants, or can be readily educated to want.

Combustibility.—As regards combustibility, or burning quality of tobacco, here again in purchasing and blending dependence is placed on knowledge of the source of tobacco, that is the district or "belt" in which it is grown, rather than on any feature discernible on inspection. Thus Maryland leaf, and to a lesser extent Burley tobacco, is used in the blend to ensure good combustibility, just as a varying proportion of Turkish leaf is used to give a distinctive or "different" aroma in each of the numerous brands of tobacco or cigarettes placed on the market.

Colour.—The flue-cure Virginia type of leaf (not necessarily grown in Virginia) is depended on mainly for colour, the more marked "yellowing" or lightening of colour being a constant result when the "curing" process is quickened by flue curing. Lightness of colour has somehow come to be associated in the public mind with "mildness." Assuming the terms "mild" and "strong" have reference to the narcotic effect on the smoker, which in turn may be considered as being in ratio to percentage nicotine content (although this is not definitely proven, then it is true that such dark-coloured tobaccos as "Perique" and "Cavendish," as also the somewhat lighter coloured "Latakia" are "strong" in proportion to their darkness of colour. It is equally true, however, that many light-coloured tobaccos are almost equally strong, one well-known brand of cigarettes having a higher nicotine content than "Perique," while some of the high aroma Turkish tobaccos are less than half the "strength" of ordinary Virginian types as regards nicotine content. The craze for light-colour tobacco which has been so strongly developed in recent years in Australia and in England has not affected the American consumer to anything like the same extent. Many of the popular brands of cigarettes are dark by comparison with the popular brands in Australia.

That colour is not regarded as a hallmark of quality in America is shown by the variation in depth of colour that may be commonly observed in different packets of the same brand, and even in the same packet. The popularity or heavy consumption of any particular brand of tobacco appears to depend largely on the amount of advertising it receives. (Recent instances of this truth are the sudden "change-over" in America to "Old Gold" cigarettes, and in Australia to "Temple Bar" pipe tobacco.) Indeed, the "merits" of tobacco seem to vary from time to time according as the consuming public is educated

by advertising and propaganda as to what they should regard as merit in tobacco.

The Manufacture of Tobacco.

By this is meant the treatment to which cured and aged tobacco is subjected to effect the transformation into the varied forms in which tobacco is used—cigars, cigarettes, pipe tobaccos, chewing tobaccos, and snuff. Manufacture also includes the blending of varying proportions of different types and qualities of tobacco leaf of varying age to produce the innumerable forms in which tobacco is retailed to consumers.

On this matter of forms or kinds of tobacco a striking difference exists between what is the vogue in England and in America. In England, London particularly, the tobacconist shop windows are principally used for the display, uncovered on plates, dishes, &c., of an almost infinite range of tobacco. All sorts of types, blends, and mixtures are there to attract the fancy. Fine and coarse-cut tobacco, flake cut, granulated, cut plug, cut twist, and many other forms are there to enable a choice to be made by actual inspection of the tobacco before the purchaser enters the shop. In America all tobacco is sold in packages, and the tobacco that one purchases cannot be seen until after the purchase is made and the package opened. Unless the purchaser has had experience of the brand, dependence has to be placed on the brand, name, or short description on the package or container. There need be no hesitation in saying that the average tobacco one is able to purchase in America, whether for cigarette rolling or pipe smoking, is definitely inferior to that available to the Australian or English consumer, and the same may be said of the ordinary run of American cigarettes—the 15 cents per packet of 20 grade. Packets of the same brand, and indeed cigarettes in the same packets, frequently vary in degree of compactness especially, but also in colour, aroma, and burning intensity.

To produce the innumerable kinds of tobacco in its various forms for smoking, and possessing the many different qualities and attributes that characterizes tobacco nowadays, is an art that has been developed enormously during the last half century. When by comparison it was a very crude art it was governed by secrecy of the methods employed, and as it has developed in refinement, its secrets have become more intensified and mysterious. They are sacrosanct to all subordinates in the different departments of factories, and they are guarded by an organization of the procedure within the factories whereby the employees, while contributing by their work to the elaboration of the product of the formula, remain ignorant of the part their work plays in the succession of stages through which manufacture proceeds.

The formulæ which governs the stages of manufacture relate to mechanical, physical, and possibly chemical factors during the process of manufacture, but strict adherence to them is especially important as regards the selection of types of tobacco for blending, and to the proportions of each necessary to secure a desired character, as well as to the preparation and application of the various "sauces" and other adjuvants that are used at certain stages of manufacture.

In discussions on this matter of adjuvants in the final stages of tobacco manufacture, I found there was a consensus of opinion that,

while they had a very well marked effect on the taste, flavour, burning quality, and even aroma of tobacco, both in masking undesirable qualities and in producing a distinctiveness that might be attractive or seductive to certain classes of smokers, they did not intensify or impart the characters of specific types to tobacco which did not inherently possess such characters. In other words, specific tobacco type characters cannot be added by manufacture treatment of any kind to a tobacco not possessing such type characters inherently.

Tobacco Plant Diseases and Pests.

American tobacco-growers have to face a much more numerous array of enemies of this nature than have appeared in Australia as yet, but none of these, not even the dreaded "Wild fire" disease, nor the whole of them have adversely influenced the progress of tobacco culture in America to the extent that our one major trouble in Australia, viz., Blue Mould (*Peronospora*) has retarded development in Australia. While Australia has few of the American diseases and pests, America is practically free of Blue Mould. It is reported as having appeared in Georgia and Florida in the seed beds in 1921, but its incidence was evanescent, and no further outbreaks have been reported. A comparative study of meteorological and atmospheric conditions, including temperatures, sunlight, humidity, and the like, prevailing in the United States of America tobacco belts, and in, say, the Ovens Valley district of Victoria, might be well worth the attention of investigators. Except for such help as such a study might afford, it is obvious that no direct inspiration can be got for researches into Blue Mould from America. The Blue Mould problem is of little or no interest to the tobacco-growers or to scientific workers in other countries, but it is of vital interest to the Australian tobacco industry, and the attack on it is, therefore, an Australian obligation solely.

Conclusion.

I have intended that this report should set out for the consideration of the Committee, observations made and information obtained abroad that appears to me relative to the position of the tobacco industry in Australia, and to the investigation that the committee is engaged on. I have not considered it my province in this report to make recommendations as to the lines of action to be pursued in the investigation. Recommendations may possibly emerge or be indicated by the reaction of my colleagues on the material I have put forward for consideration, and I trust it will be regarded as worthy of critical notice and discussion to that end.

It may, however, be permitted me to say, in conclusion, as one who has perhaps had the lengthiest official experience of any one in Australia of administrative efforts to promote the tobacco-growing industry here, and of its vicissitudes, that I regard the Blue Mould problem as of foremost and most vital importance. The solution of the problems relating to quality and aroma, to grading and marketing, to soils and climatic suitability and cultivation methods, will be assisted materially by the increase of production which will immediately follow on the suppression of Blue Mould.

Similar problems and difficulties have arisen in either countries newly engaging in tobacco production—notably India, Canada, and South Africa, and in each case they have been met and surmounted.

I have also indicated my view of the importance attaching to investigation into Australian methods of processing and ageing of tobacco prior to manufacture, and the desirability of the Committee concerning itself in the matters of marketing reform.

THE WINTER FEEDING OF DAIRY COWS.

By J. M. Kerr, Chief Dairy Supervisor.

As the first part of a food's function is to maintain the body-heat and energy (which are the animal's very life), apart from any question of essentially subordinate body-growth or milk secretion, it follows that a cow *does* require more food in cold than in warm weather. The very first reason for food at all is to maintain normal body-temperature in the animal. The call for this purpose is greater in the winter than in the summer, simply because a cold atmosphere draws off more heat from the body-surface, with which it is in contact; this loss must be replenished by greater combustion of the body's only possible fuel—the food.

We can, of course, apply rugs to the animals to hold this body-heat from escaping airwards, or we can even stall the stock in stables on cold nights with the same object, but, after all, it is food-consumption and combustion on which we must primarily rely to furnish, and ever furnish, the body-heat, which is absolutely vital to the animal. Till this can be first ensured, there can be no question of a milk-yield at all. If the heat which the animal either uses or loses, amounts to more than there is body-fuel to replenish, body-temperature must fall unless the animal has some reserves of fat on her bones, or in her tissues to be, as it were, thrown into the furnace, in case of such emergency. This rather disgraceful emergency occurs in thousands of our cows all too regularly, but we invariably see it at its worst in the winter. All farmers know the sign, even if they do not know its true import. They refer to it as the losing of "condition." It is really and truly a distress signal, and has but one significance, namely, that the cow is not receiving enough fuel (or, in other words, food).

Such a conspicuous signal should be altogether unnecessary, because one may depend that the cow has given previous signals by way of a failing milk-yield—a sure sign of an ill-nourished udder. A fall in the milk-yield, following shortage of food, is bad enough, but when the general body-cells—the machinery of life itself—fail as well from the same cause, the farmer (whose financial well-being lies in the amount of butter-fat his farm will produce) would do well to regard the position as gone seriously far.

A wasting cow, however well-fitted by nature for a dairy-cow's work (of converting vegetable matter into milk) cannot possibly be more than half a cow, if she be given but half a cow's food supply. One can never get a full cow's milk from half a cow's food material, nor an efficient

cow's work from an over-wasted body. This costly lowness of condition is much more common in winter than in summer, because (to put it shortly) more food is needed and less food grows, or (still shorter) hunger is greatest and growth least. This double attack, as it were, means that tissue-fat is burned up from cells which can ill-spare it, to do work, which daily work any efficient dairyman would wish to see done by the food supply of each respective day. To one who has sufficiently well learned the elementary lesson that nature practically closes down her vegetation workshops in the winter months, this ideal of a day's food for each day's need suggests one thing—fodder conservation.

In determining what foods one shall use for dairy cows in winter, there is, of course, the winter-call for more heat to be taken into consideration, but in view of the fitness of almost every farm-grown hay-crop for this elementary function of heat generation, the call is rather to grow *enough* of anything, rather than any particular variety.

Hay and Ensilage.

Winter feeding must, of course, always be largely a matter of drawing on fodder-reserves and, as a reserve for winter milking, nothing is better than good legume hay, made from any of the well-known legumes, such as lucerne, clover, cow-grass, trefoil, &c. Meadow-hay, which is a mixture of grass and clover, is also excellent, and grass-hay is good, but not quite so good as if it contained clover in conjunction. Even oaten hay is a fine standby, but this material is better to be conserved when relatively green as ensilage. In fact, every crop, with the exception of purely leguminous ones, makes better stock-feed as ensilage than as hay.

With all hays, it is very important that they be well "saved." If not, more will be required to do a given work, which, with the capacity of the stomach a fixture, means that the same amount of work is never done with poor hay as is done with good. There is more difference between leafy lucerne hay and stalky lucerne hay than there is between lucerne and something else altogether. Ensilage-making is not nearly so exacting as hay-making. This is where maize (or, as the Americans call it, corn) is of value. Maize is the ideal crop for ensiling, and maize-ensilage (as full as it is of the effective fuel nutrients—starch and sugar) cannot be economically excelled as a basis for a ration either in summer or winter. Its virtues, for maintenance purposes, lie in the abundance and cheapness of its carbo-hydrate ingredient, which nutrient is, after all, but digestible carbon, and carbon can always be relied on to burn and warm to some purpose. Good maize-ensilage is, in fact, the ideal maintenance material for a hand-ration here in Australia.

If 30 lb. of maize-ensilage and 10 lb. of lucerne hay per cow per day be fed, the maize ingredient will practically meet the preliminary maintenance need, leaving at least 8 lb. of the leguminous ingredient available for udder duty.

Concentrates.

An efficient dairy cow so fed should produce about 2 gallons of milk a day, without any loss of body-weight at all. In America, where the leguminous factor seems to be more generally appreciated than here, 10 lb. of lucerne hay and 30 lb. of maize-ensilage is considered the full

daily due of any cow till she has demonstrated her ability to produce more than half a pound of butter-fat a day. Beyond this, of course, a cow will deserve more, perhaps even to the extent of some concentrate material, which no business-like dairyman will then begrudge her.

Every ration should have its maintenance element in the cheaper forms of fodder which the farm itself should be expected to grow. This home-grown roughage may then be built on to with foodstuffs of more concentrated nature, such as the oil-meals, bran, pollard, polly-feed, crushed oats, &c., according to the cow's deserts as shown by the scales and testing machine.

As far as cows are concerned, goodness means profitableness, and profitableness, goodness; and we do know there is such a thing as a good cow. No cow, good or bad, ever made milk-profits except from the food. For the cows that will pay for them, the more concentrated class of foodstuffs known as "concentrates" is well worth while, as supplements to the cheaper and coarser home-grown foods; but care must be taken, of course, not to feed them beyond the cow's capacity to repay. It is of no use feeding expensive milk-making material to a cow that has no machinery fitted to deal with it in that particular direction.

If we feed a cow beyond her capacity to utilize it, she is fooling us; if we stop short of this point we are fooling ourselves, which is still less excusable. Only a dairyman who keeps records will know where this point is in his different cows; it will certainly not mean the same amount of money spent on each of all the cows.

Now, if concentrates are advisable at all, it is possible to introduce a greater heating principle by the same act. As well as being rich in protein (or milk-making material), the oil-meal forms of concentrates are also rich in oil—the most combustible of food nutrients. The digestion of a given weight of oil or fat-nutrient produces much more heat than does a similar weight of either carbo-hydrate or protein. In winter, therefore, the dairyman fortunate enough to have cows that will pay better with concentrates than without, would do well to include one or more of the oil-meals in the concentrate ingredient of the ration. They are best used as a proportion only, and must not be fed too liberally, for the relatively high oil-content is too much for the cow's digestion. If a quantity of anything over 3 lb. of oil-meal per cow per day be fed, the herd should be watched for possible ill effects, but up to that point the oil-content will do good rather than harm. Because of their oiliness, such foodstuffs as linseed meal, coconut meal, maize oil-meal, and cotton-seed meal have an additional recommendation in winter time.

If it were possible to get the best results without any hand-feeding at all, all reference to such things as hay, ensilage, and concentrates would be sheer waste of time, but every dairy farmer who knows his work knows that no year is free from occasions (whether short or long, no one can predict) when paddock pasture, or anything that can then be provided in the nature of grazing, is more or less inadequate for the bare needs, to say nothing of the full possibilities, of a good dairy cow.

Provision of Winter Feed Requires Forethought.

There are many men who discover the advantage of hand-feeding during these times but they find it when it is too late. Winter feeding

of dairy cows as they should be fed is a matter requiring forethought, simply because winter itself is not a growth season. The true art of the dairy farmer is revealed in nothing so much as in the degree to which he keeps the essential full and plenty food-supply up to the cows the year round. It is generally too late to think of winter feed when the winter shortage is a reality. Whether it is a matter of fodder conservation—putting by—or of providing the food in the form of to-be-grazed fodder crops, it must be thought of at least some months in advance. The alternative is purchase, and whether that pays or not, it certainly does not pay as well as making the farm land grow the fodder.

It is a sad business when one has already incurred the heavy liability of landed property, to have to purchase such readily-grown material as the common farm roughages. And yet we do at times see dairy farmers carting on to their farms hay material which some other farmer has grown for them; but even this is better than the commoner practice of feeding cows inadequately.

The only way to avert these happenings is to plan in advance, and to do this, farmers must take another view than the ordinary one regarding the difference between spring and winter. It is not farming in the true sense at all to have to purchase roughage or bulk-fodder. The growing of either hay or of crops for ensilage is the land's first obligation. The purchasing of concentrates to ensure a proper balance of the hay or ensilage, already well-conserved, is a different matter and is quite conceivably a money-making business.

Economy does not Necessarily Mean Cheapness.

All feeding is a matter more or less of a loan to the cow and presupposes trust or confidence in her ability to repay the cost and a bit over. If one does not know the relative merits of his cows, all feeding-cost may well be a speculation, but if one has limited his herd to proved and consequently undoubtedly good cows, anything that makes for better feeding is in the nature of a safe investment. If bringing good fodder and a dairy cow together does not result in a covering milk-secretion, the remedy for the cow-keeper is not in withholding the fodder, but in changing the cow. It either pays to feed cows to the point of physiological efficiency of the vital organs, or it does not pay to keep them at all. At the same time it behoves one to feed them as *economically* as possible. This does not mean as *cheaply* as possible. The cheapest feeding obviously is to give them nothing at all—neither land nor provender. It is very easy to lose money (or at least the chance of making it) by cutting down on the food-cost—so easy that the very worst of our farmers are able to do it. If one can cut down on the feed-cost without losing anything in the way of yield or gross return, that is certainly good business.

Therefore, although the means of hand-feeding should always be available, firstly in the shape of ensilage or hay, and secondly in the more concentrated form of such foods as the various grains, brans, pollards, and oil-meals, one does well to try to keep the need for any hand-feeding down as low as possible.

The Growing of Fodder Crops.

Fortunately, to any farmer caring to look ahead, there is a means of considerably reducing the cost of winter feeding. This lies in exploiting, to the fullest extent, green crops of the hardy cereals. Cereals such as Algerian oats, barley, and rye do make some growth even in winter, provided they have a fair root system developed before the ground has become too cold. The moral is, of course, sow them early in autumn—as soon as the drought of summer has sufficiently broken to ensure their survival. These crops, in their young stages, are succulent and well-balanced for milk-production, and are quite capable of keeping the cow in flesh and producing up to 4 gallons of milk at the same time.

A mixture of oats, barley, rye and wheat gives variety, and can usually be had ready for grazing by the end of April. It should be sown as soon as the summer has broken, and at the rate of 20 lb. oats, 20 lb. barley, 15 lb. wheat, and 15 lb. rye. This crop can be grazed right out in the spring, and the ground again broken up for re-sowing. If oats be used solely, sow 70 to 80 lb. per acre. The crop may be grazed off again and again up to about August, and the paddock then closed up to allow of an oaten-hay crop being harvested about November or December. For a suitable oat there is no need to go beyond the well-known Algerian variety. Once this oat has stood it will stand periodical grazing-off throughout the winter better than will any other crop. If the land is too wet and liable to “pug” these green crops are better cut by hand and cast over the fence to the cows.

Green feed being so soft and succulent is generally the better for a little hay in supplementation; but excellent results will be obtained from the green feed alone.

It must be remembered that cereal crops are all naturally deficient in lime, and if a cow is being forced to give good milk yields on green cereals alone, she will need some extra source of lime. If lucerne or clover hay cannot be added, give a few ounces of bone-meal in the manger to each cow daily. Peas or vetches sown with the crop serve well while they last, which is usually not long after the first grazing.

Points to be remembered in regard to the winter grazing-off of the Algerian oat or, for that matter, any other winter crop, are:—

Sow early (generally in March) while the ground is warm and yet moisture reasonably assured.

Let the plant get out of the single-blade stage before attempting to graze.

Always keep the crop down to under 9 inches, yet don't over-graze; give the plants a chance to come again. An hour or two each day will serve for the cows to fill themselves; turn them off before they want to lie down.

Do not continue to graze the crop much into the dry weather if a harvest crop is expected from it. August is usually late enough for grazing any crop.

It is, of course, too late now to sow for winter feed, but the chance should not be missed next year.

THE PROGRESS OF HERD TESTING.

By W. J. Yuill, Senior Dairy Supervisor.

(Continued from page 240.)

A Comparison of New Zealand and Victorian Results for 1928-29.

New Zealand has several systems of herd-test work; that known as the group system is the most extensive and influential. The main features of difference between the New Zealand method and that of this State is the extra 30 days of test period and the exclusion from all records of cows that fail to milk 100 days.

A comparison of the year's work shows that the best herds and cows in this State compare favorably with those of the Dominion, but in the general average of numbers and production New Zealand is considerably ahead. In the Association average, Yinnar No. 1 appears to be the only unit which has exceeded 300 lb. of butter-fat per cow for two successive years. The total number of cows in this association, however, is much lower than the number in the leading association in New Zealand.

The year's comparison is set out below:—

	New Zealand.		Victoria.	
	Cows.	Butter-fat.	Cows.	Butter-fat.
		lb.		lb.
Cows tested	77,591	244·89	63,277	222·37
High association	984	304·7	598	305·3
2nd association	1,222	284	984	287
High herd	4	408	16	462
21 to 30 cows	29	400	20	419
31 to 50 cows	35	390	33	391
50 to 75 cows	66	385	59	393
75 to 100 cows	89	364	93	363
Over 100 cows	108	328	106	343
High cow in 293 days	..	769	..	..
High cow in 273 days	..	..	..	829

TABLE SHOWING POSITION OF HERDS AND COWS IN RELATION TO PRODUCTION.

	Cows.	Percentage.	Herds over 300 lbs.	Percentage.
Over 400 lb. butter-fat	1,233	1·95	9	..
300 to 400 lb. butter-fat	8,936	14·10	227	10·6
200 to 300 lb. butter-fat	28,355	44·80	1,195	53·6
Under 200 lb. butter-fat	24,755	39·15	798	35·8

TABLE SHOWING CONSISTENT PRODUCTION BY GRADE COWS IN HERD TEST ASSOCIATIONS IN VICTORIA OVER A NUMBER OF YEARS.

Name.	Association.	Years Tested.	Number of Cows.	Average lb. of B.F.
J Charlton ..	Stony Creek ..	5	24	359
J. J. Desmond ..	Rochester ..	4	16	399
T. Collins ..	Yinnar ..	4	22	390
C. Macauley ..	Rochester ..	3	18	381
J. Flegg ..	Kerang ..	3	17	378
H. C. Keele ..	Rochester ..	3	16	377
Smith Bros. ..	Mirboo North ..	3	26	371
Moore and Co. ..	Yarram ..	3	93	348
D. Jarvie ..	Rochester ..	3	29	342
G. Horsburg ..	Yinnar ..	2	16	436
S. Ross ..	Stony Creek ..	2	15	401
H. Schier ..	Rochester ..	2	33	391
G. Beasley ..	Swan Hill ..	2	17	383
H. Furphy ..	Dumbalk ..	2	40	374
J. Pearson ..	Stony Creek ..	2	24	372
D. Nicol ..	Tallangatta ..	2	50	328
Moore and Co. ..	Yarram ..	2	106	315
J. Clyne ..	Maffra ..	3	63	304
J. Clyne ..	Maffra ..	2	66	311

SOME OUTSTANDING GRADE COWS.

Owner.	Association.	Name of Cow.	Age.	Highest Yield.	Average Yield.
			Years.	lb.	
Moore and Co. ..	Yarram ..	Saucey ..	3	745	640
Moore and Co. ..	Yarram ..	Darkie ..	5	583	523
J. Charlton ..	Stony Creek ..	Ruby ..	5	530	500
G. McLeigh ..	Stony Creek ..	Daffodil ..	3	573	560
H. Furphy ..	Dumbulk ..	Darkie ..	3	591	567
H. Furphy ..	Dumbulk ..	Princess ..	2	602	593
J. Clyne ..	Maffra ..	Bonnie Maid ..	3	625	582
H. Schiers ..	Rochester ..	Pet ..	..	626	538
J. J. Desmond ..	Rochester ..	Munro ..	4	600	480
Smith Bros. ..	Mirboo North ..	Kate ..	3	..	482
J. Mathieson ..	Myrtleford ..	Topsey ..	4	571	462
J. Mathieson ..	Swan Hill ..	Jet ..	3	564	462

Factors which have Aided the Increased Production.

Of all the factors that have been responsible for the development of higher returns, undoubtedly better feeding methods have played the major part.

On 3,000 dairy farms in this State herd-testing work is quietly stressing the great need of more and better feed for 365 days in the year.

More attention is being given to the pre-calving rest period. It is slowly being realized that this is not a time at which to save a paltry

sum by allowing a cow less than her actual requirements. It is a time for the cow's preparation for the coming season—not of exploitation, as has been too often the case in the past.

The necessity for renovating and top-dressing pastures is slowly being appreciated. The feeding of more legume hay and a rational use of concentrates and minerals are being practised. The best means of conserving fodder is receiving more attention.

Another factor of great importance has been the extensive speying of low-yielding cows.

The records show that more than 19,000 junior cows were under test in 1928-9; of this number 1,219, or 6.4 per cent., produced over 300 lb. of butter-fat. This is evidence of the class of young stock that is replacing the culled cows.

In 61.5 per cent. of the herds under test a pure-bred bull is used. A number of units have 100 per cent. of their herds sired by a pure bull.

Some Striking Instances.

Herd-test records supply some remarkable facts concerning our grade herds and cows.

"Dot," the leading cow of the year, produced 14,632 lb. of 5.66 per cent. milk, equalling 829 lb. butter-fat. Her yield of milk on the last test was 47 lb., and her average daily quantity of butter-fat throughout the test period was over 3 lb. "Mona," calving under 4 years, produced 682 lb. of butter-fat; while "May," as junior 2-year-old, produced 465.9 lb. of butter-fat, and re-calving while still under 3 years, yielded 634.9 lb., a total of 1,100 lb. before she was 4 years old.

Mr. Moore's best ten cows from his several share dairies averaged 630 lb. of butter-fat.

Another instance of remarkable development of milking excellence in a young cow is Mr. H. Desmond's "Pet," which calved at 13 months old. She has now, at the age of 4 years and 8 months, completed her fourth lactation, for each of which her average production has been over 400 lb.

At Mirboo North, "Beauty," a grade milking Shorthorn cow, when 22 years of age, produced 430 lb. of butter-fat. Her owners, Messrs. Smith Brothers, state that this cow has calved regularly since she was 2 years of age, and has never had a day's illness.

During the past few years there has been 100 per cent. increase in the number of cows under test. Five years ago the average yearly production was 190 lb. per cow; to-day it is 32 lb. greater.

In the early history of the Standard Herd Test, a cow yielding 500 lb. of butter-fat was rare; to-day there are hundreds that reach the 600-lb. standard, while 700 and even 800 lb. have been exceeded on several occasions, and an average of 500 lb. for a whole herd has been obtained.

History repeats itself in the work among grade cows. During 1928-9, 125 animals exceeded 500 lb., and a herd of sixteen cows (without any age allowances) averaged 462 lb. per cow.

As the hope of the industry lies in better-fed and better-bred sires, greater value must be placed on the sons of known consistently high-producing pure-bred cows.

Such bulls as "seed stock" offer a great opportunity to improve the standard of our dairy herds, and the best bulls are none too good for this work.

Herd-testing dairymen are now keen to secure the best. They join the Dane and the Swede, and many other testing people in echoing a statement made in a recent American Dairy Bulletin that "pedigree alone can never determine a bull's value." The dam's record of production is like a promissory note—her son's high-producing daughters are the cash in hand.

As long ago as 1875, Professor Coleman, an English authority, wrote:—"If a farmer buys a bull because he has a pedigree, and has no knowledge of the milking qualities of the family he comes from, he does not deserve to be lucky in his purchase."

"Cow Racing and Record Chasing."

It cannot be denied that there is a fascination in attempting to break records. Whether it be some absurd trial of human endurance, or the obtaining of the highest yield of milk from a cow in a day or week or a nine months lactation period, in every instance it is true to say that each new record is but another to be broken.

It is not so long ago since a yield of 1,000 lb. of butter-fat in a lactation period was looked upon with suspicion, and the 3,000-gallon cow was a rarity. To-day there are large numbers of both classes: "Segis Peterzia Prospect" produced 3,700 gallons of milk in 365 days. "Traverse Colantha Walker" has a nine-year average of 840 lb. "Vive La France," the champion Jersey cow, has a six-year average of 890 lb. of butter-fat. "Nellie Osbourne," the champion Ayrshire for two years, has averaged 2,521 gallons and 1,130 lb. of butter-fat. "Melba 15th of Darbarlara," the Australian Milking Shorthorn cow, for two years averaged 30,977 lb. of milk and 1,463 lb. of butter-fat.

"Augusta 26th," a German crossbred cow, is credited with a record of 28,000 lb. of milk and 1,691 lb. of butter-fat in 365 days. A New Zealand grade cow gave 888 lb. of butter-fat in 306 days, and a Victorian grade Jersey cow has yielded 829 lb. of butter-fat in 273 days, producing 47 lb. of milk on the last test day and 90 lb. of butter-fat in the last 30 days of test.

World records are interesting; State records are equally so. It is also interesting to hear of a cow like Mr. Moore's "Dot," and cheering to know that large herds of grade cows are improving in their yields as a result of rational feeding of farm-grown forage.

Are Pure Breeds Better Dairy Animals than Grades?

Many and varied are the opinions held on this question. Breeders of pure-bred stock have long had the idea that pure-bred cows are superior as producers to crossbred or grade cows. On the other hand, owners of grade herds have quite commonly believed that pure-bred animals lacked hardiness and constitution.

An accumulating mass of data disproves both ideas. Pure breeds are not necessarily good dairy animals because they are pedigreed, but on the other hand (if not coddled when young), will "stand up" to any condition of rational dairy farm experience. The modern dairy cow is a digesting machine, and is not now fitted for an endurance or hardship test.

Grade herd-testing work is unlike that of pure-bred work, in that there is less sentiment associated with individual cows. Consistent producers remain in the herd in spite of plainness, while in pure-bred herds fine-looking pure-bred cows often remain in spite of continued low production.

The writer of Bulletin 1470 of the Department of Agriculture, United States of America, in his summary, says, *inter alia*, that the failure of the pure breeds to outstrip the grades in production is due to the common tendency to see greater value in pure-bred cattle and their consequent retention until a "pure-bred" price is obtainable, while the grades are culled on production.

Every breeder of pure-bred stock is the custodian of the type, conformation, and characteristics of the breed he favours. There is an obligation to develop his breed to the best of his ability. There is, however, a greater obligation, and that is to develop only those families that have high dairy as well as breed quality.

In the 3,000 herds under test there are many pure-bred cows, which, when working under equal conditions, show no superiority as producers over their grade sisters.

The truth is that, as with grades, so with pure breeds, constant culling is essential, for sentiment has no value at the factory.

From the records of the "Dairy Cattle Improvement Societies," the United States of America Department of Agriculture has made extensive comparisons between grades and pure breeds. The results show little variation in production, although the proportion of grades is usually high. The following figures are taken from Bulletin 1490, issued by the United States Department of Agriculture:—

Pure breeds, 2,919; average, 288 lb. butter-fat.

Grades, 14,458; average, 258 lb. butter-fat.

Difference in favour of pure breeds, 30 lb. butter-fat.

Wisconsin—

Pure breeds, 7,285 lb.; average, 291 lb. butter-fat.

Grades, 26,669; average, 290 lb. butter-fat.

Difference in favour of pure breeds, 1 lb. butter-fat.

Massachusetts—

Pure breeds, 12,830; average, 296 lb. butter-fat.

Grades, 34,031; average, 281 lb. butter-fat.

Difference in favour of pure breeds, 15 lb.

Los Angeles—

Pure breeds, 951; average, 362 lb. butter-fat.

Grades, 8,984; average, 354 lb. butter-fat.

Difference in favour of pure breeds, 8 lb.

When the Holstein Society of United States of America decided to test all cows in the herd, the registration papers of 440 cows were surrendered, the owners not wishing to have the records of these cows published.

There are pure breeders who say that they will go out of breeding rather than go into the test. Such men will never be missed, for the factory cheque is of greater importance to-day than is the show-ring prize card.

Many owners of good grade herds aspire to become owners of pure-bred herds; "production pure-bred" cows will thus be spread further afield.

The sons of nondescript cows are hopeless for building dairy character into a herd, no matter how good those cows may have been as producers.

There are also many tested pure-bred cows equally unsuitable, for they lack dairy capacity. Despite anything that visiting judges may say of this State's pure-bred cattle, the fact remains that the sons of these cows are developing a high dairy aptitude in our grade herds.

Better-bred, better-fed cows should be the slogan of every dairyman in the herd-test movement.

It is well to remember that without a pure-bred bull grade herds cannot be developed. Herd-testing dairymen are unanimous in their opinion that only production-bred pure bulls should be used.

Correction.—In the *Journal* for April, page 238, in the table showing Increased Average Production of Cows in Associations, the average yield of butter-fat per cow in the Yinnar Association was given as 205.3 lb.; it should have read 305 lb.

CARE OF EWES AT LAMBING TIME.

By N. A. Bowman, Sheep and Wool Expert.

The commencement of the lambing season brings onerous tasks to most sheep-breeders. The station-owner, with his stud flocks, spares



Correct Way.



Incorrect Way.

Crutching Sheep.

no effort to secure the maximum results when valuable sheep are at stake. Those who farm on a smaller scale must also recognize their responsibility in this direction; every lamb saved will become an asset to the State, and farmers who in the past have followed haphazard methods should take a more serious view of the duties that lambing

time brings. In this article attention is directed to the work of handling breeding ewes during this critical period in the development of the flocks of the Commonwealth.

Crutching.

One of the essentials necessary for increasing the percentage of lambs that will be reared is a more general practice of what is known as "crutching."

The breeding ewes should be crutched some three weeks or so before they commence to lamb. In handling them, great care should be exercised so as to lessen any danger of mishaps. When taking the ewe from the catching pen, she should on no account be carried by her fore-end; such action may cause her to lose her lamb. She should be led out of the catching pen, and, when placed on the crutching board, turned up very carefully. Much time and energy are wasted by handling sheep roughly. To turn a sheep up carefully and conveniently, place the left arm under the jaw and catch hold of the right cheek; then turn the head to the left and upwards; at the same time pass the right hand over the sheep and take hold of the left hind leg and pull it with a forward motion towards the centre of the belly, and the sheep will fall gently on her rump and in just the right position to be crutched.

To do the work properly the whole of the crutch up around the tail-head under the hind legs should be shorn. In some cases I have heard sheep-farmers say that, where the country is carrying burr to any large extent, they find it pays to clean up in front of the thighs, also in front of the udder, so as to ensure that the lamb will have no difficulty in finding the teats.

Careful handling cannot be over-stressed. There should be no sudden drop into the shorn-sheep pens, and to prevent crushing, the ewes should be counted out when the pen is little more than half full.

Lambing Paddocks Desirable.

Ewes should not be excessively fat at lambing time; good strong store condition is the best. Where possible, special paddocks should have been spelled in order to furnish fresh clean pasture for the lambing ewes. On large station properties, where there are capable married men living on the run, it is the practice to reserve paddocks near their houses for the ewes. This enables the men to give them closer attention at the most critical time. It is advisable for one to go among them as much as possible just before lambing time in order to get them well accustomed to being rounded up and handled. They soon become quite used to the presence of the man who is looking after them, and will neither run away nor show any alarm at his approach. Only well-broken, silent, and wide-working dogs should be allowed among the ewes. As sheep are, perhaps, the most nervous of all domestic animals, it is a great advantage to have them quiet before lambing, so that, in the event of any requiring special treatment, they are less likely to suffer from nervous shock. It is of the utmost importance that the ewes, during this period, should be healthy. To ensure this a good supply of salt or a lick should be available to them.

In districts where foxes are prevalent it is a good plan to put strychnine on the bodies of lambs that have been killed—just sufficient to cover a sixpence is the usual dose. Sparrows, starlings, and parrots are also good bait. Of course, it must be remembered that, by poisoning dead lambs, &c., it is quite possible to catch innocent dogs—and others.

Care at Lambing Time.

The man whose task it is to look after the ewes should be out at daybreak, and look first to the sheep camp for any ewes which may be in difficulties. Sometimes a ewe that is extra timid may desert her lamb. Should one show signs of doing this, she ought to be tied down and the lamb laid at her head. It will not be very long before the mother will take kindly to her offspring, and she may then be let loose. Another good plan to meet such circumstances is to make a small yard with three hurdles, and place the ewe and the lamb therein; this method is especially suitable for smaller holdings.

Full attention must be given to each and every flock daily. Early morning and late evening are the best times to be among the ewes and lambs. In the case of ewes that have not previously had a lamb, one should make it a practice to be among them three or, perhaps, four times a day.

One of the slogans of the Better Farming Trains is—"When ewes are lambing it will pay to give them attention twice a day," but while receiving such attention they should be disturbed as little as possible. If they are watched by the same man every day, and if he rides the same horse when going amongst them, they will soon cease to be alarmed at his approach.

As a rule few complications arise during lambing, and one should be sure his services are necessary before interfering with the ewe.

Feeding Ewes.

The question of feeding breeding ewes in order to keep the lamb growing is one of great importance. Of course all breeders will not see eye to eye on this question. Some will raise objections such as that of cost, since, once the feeding of ewes is started, it has to be kept on until the grass comes away. Under present conditions discussion as to the provision of food may seem out of place, but in a normal year this certainly becomes a very important question. Mr. Richardson, of Goorin, Dobies, Victoria, gives serious attention to feeding his good ewes prior to lambing. He uses a self-feeder—details of which were published in this *Journal* for November, 1927. A photograph of the feeder is reproduced below.

The Crossbred ewe is a heavier milker than the Merino, and, therefore, requires a more juicy food. That is necessary for milk production, and milk is essential for a vigorous lamb. At the same time as she is rearing her lamb the ewe is expected to grow a good fleece of wool, and if feed be scanty and short, not only will the lamb get a setback, but the mother's fleece also will suffer.

In feeding tests conducted at the Werribee Research Farm ensilage was found to be the best fodder. A pamphlet containing records of these feeding tests, &c., can be obtained on application to the Department of Agriculture, Melbourne.

The mention of silage at once brings to the fore the question of conservation of surplus fodder against the time of drought. This subject has been preached in season and out of season for years, but with little apparent effect. There is, however, not the slightest doubt that, by cutting and storing—in the form of silage—surplus grass and herbage in flush seasons, losses due to drought may be minimized materially. Ensilage properly made is cheap, and, with the addition of some grain and salt, is almost, if not quite, equal to natural grass and herbage in maintaining sheep in health and vigour.

Hand Feeding Lambs.

When twins are born there is a liability of the mother losing sight of one of them. In a case of this sort the lamb can be saved by hand feeding. Young lambs can be reared in many different ways—some



Self-Feeder used for Sheep at Gorrinn, Dobies, Victoria.

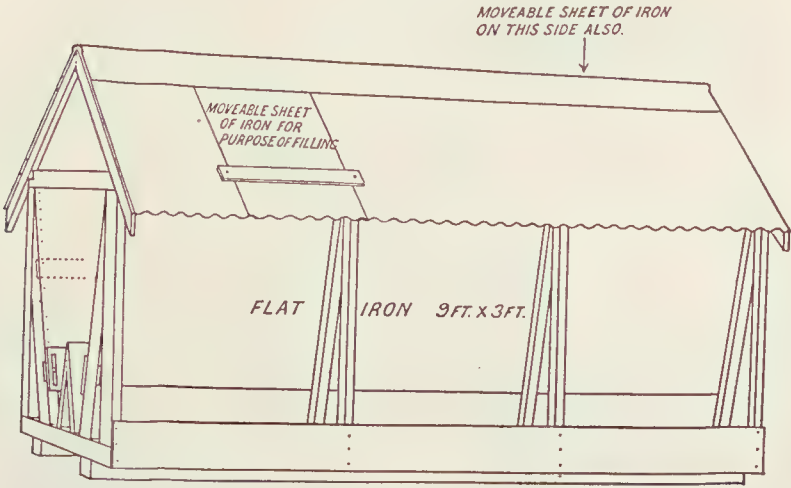
(The posts and battens are to prevent the feeder blowing over in strong winds.)

good and others bad. When lambs are first brought in they should each receive a very little cow's milk, to which warm water and also about half a small teaspoonful of castor oil has been added. For a few days they should be fed four or five times a day with milk and warm water, only two good tablespoonsful being given at a time. Later three or four drinks daily will prove sufficient until such times as they are quite big and strong.

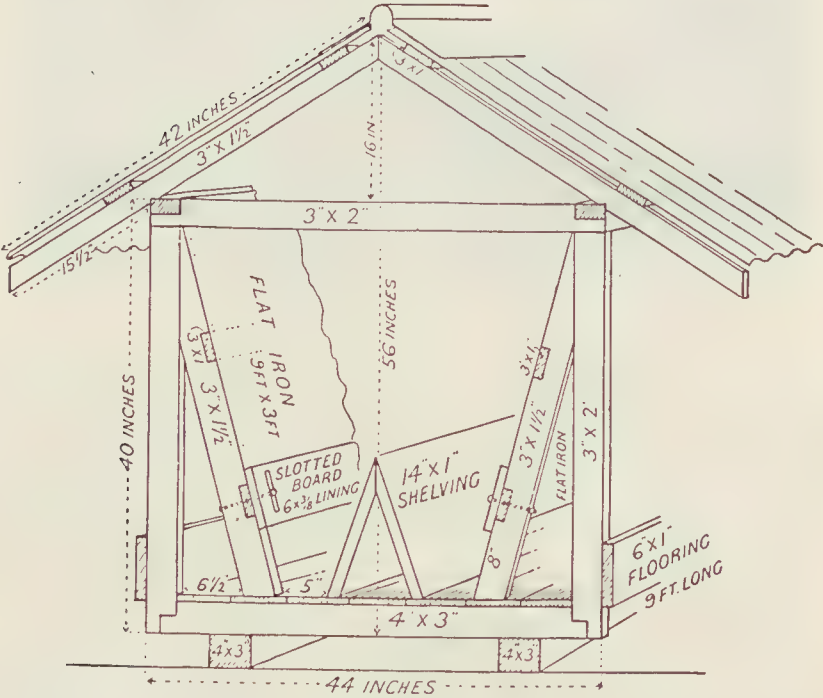
Young lambs suffer from cold, and should be kept warm at night.

The Marking of Lambs.

When the time arrives for marking and tailing, temporary yards made with stakes, wire-netting, and a few hurdles should be erected alongside a fence in the paddock where the lambs and ewes are gathered for the purpose of marking. Great care should be taken to prevent rushing the lambs; it is very desirable that they should not be overheated. Where temporary yards are used it will lessen the risk of any



Side View.

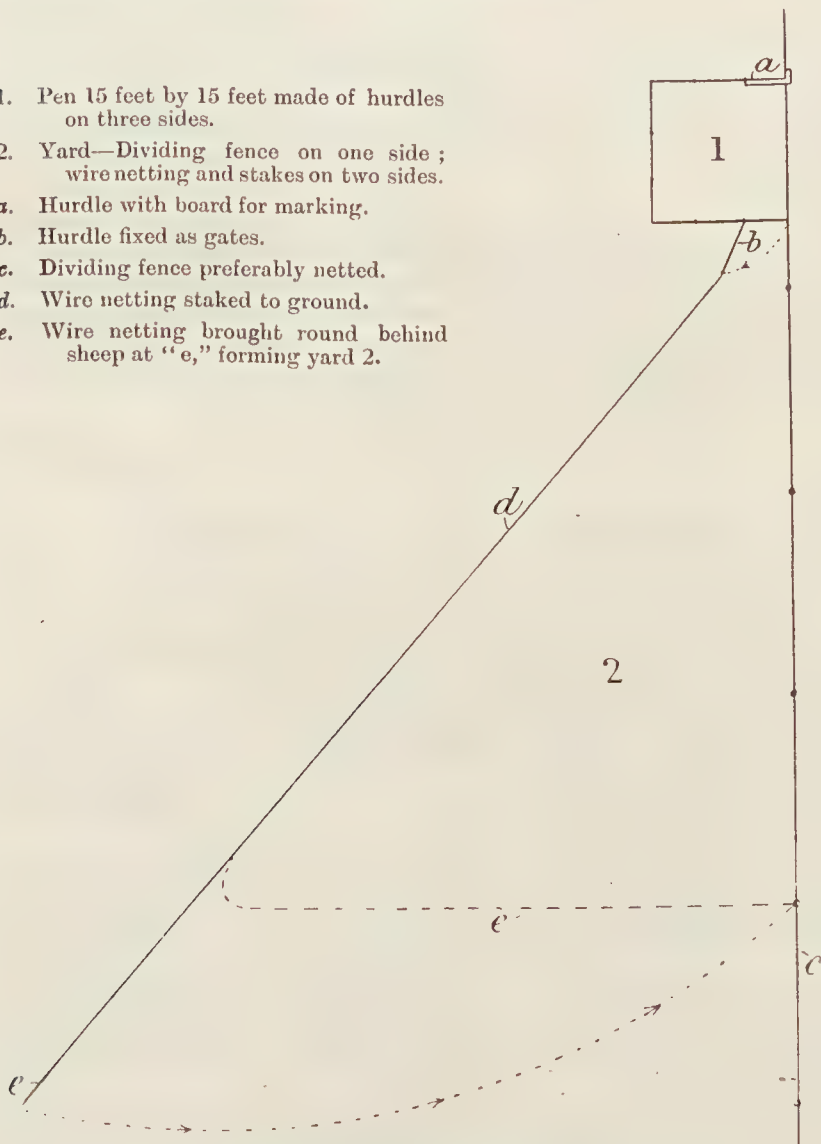


End Section.

SELF-FEEDER FOR SHEEP.

deaths from tetanus or blood poisoning, which frequently supervenes if the operation be carried out in filthy yards. If the sheep-yards are used, they should be quite clean. It is a wise precaution to disinfect them with some sheep-dip or other antiseptic.

1. Pen 15 feet by 15 feet made of hurdles on three sides.
2. Yard—Dividing fence on one side; wire netting and stakes on two sides.
- a. Hurdle with board for marking.
- b. Hurdle fixed as gates.
- c. Dividing fence preferably netted.
- d. Wire netting staked to ground.
- e. Wire netting brought round behind sheep at "e," forming yard 2.



Temporary Yard for Marking Lambs.

(Will hold 250 ewes and their lambs—scale, 1 inch equals 21 feet.)

All knives and pliers required should be thoroughly cleaned and disinfected before marking is commenced, and frequently while they are being used, say, in a solution of one part carbolic acid to twenty parts of water. The catcher should rest the lamb on its hip bones on the top

rail with its shoulders against either of his; he should catch the hind legs over the hocks and draw them forward between the lamb's fore-legs and its brisket, and hold them there. The catcher generally calls the sex and presents the ear for marking, but the marker should verify the sex before he, with his pliers, snips the ear-mark in the left for males and in the right for females. Generally speaking the tail is cut off at the second joint below the tail-head. Before it is actually cut the skin should be retracted slightly towards the lamb's body by the man holding the lamb. Then when the lamb is released the skin will overlap the end of the bone, and protect the flesh while healing is taking place.

The operator should throw the tails into two heaps as he cuts them off, males on one side, ewes to the other, so that an accurate count can be got of the number of each sex when the flock has been dealt with.

If the process of marking be carried out in a clean manner and the lambs placed on clean pasture after the operations, dressings are not necessary; as a matter of fact sticky dressings do more harm than good.

PIG FEEDING TESTS AT BOOLARRA.

By A. T. Blair, Senior Dairy Supervisor.

Following a lecture on the feeding of pigs towards the latter part of last year, some experiments were carried out at Boolarra at the farms of Messrs. A. and C. Blake, Mr. F. McIvor, and Mr. R. Halliday with the object of ascertaining the most profitable fattening methods. Tests were made in the feeding of pasture and of other foods grown on the farms, as well as with grain. The results of the tests with grain indicate that from it a profit of 50 per cent. on cost price can be made.

Considerable variations occurred in the results of similar tests carried out on the three farms. This suggests that breeding and pedigree are not the only matters to be considered; type and conformation are almost as important. The type of bacon produced some years ago is almost unsaleable to-day; the demand now is for a young, lean, and tender bacon, and if we are to have anything like a fair share in supplying it, we must offer an article that suits the public taste. It is not only in the kind of bacon required that the old order has changed. What is at present considered the test type of beef is different from that sought after twenty years since. The practice of permitting a bullock or pig to attain a certain size or age and then "topping him off" as quickly as possible is fast disappearing in favour of fattening an animal all the time it is growing. The question, therefore, arises as to whether a pig of any particular breed or conformation will produce the class of bacon required. Undoubtedly the pig which grows the quickest will be the one most economical to rear, provided it will yield the class of bacon which will command the highest price. This very desirable type of animal can be raised mainly by breeding and testing.

All the pigs in the Boolara tests were fattened in the open—in some instances the feed was fed through self-feeders; in others troughs were used. Trough-feeding is liable to result in waste, owing to the pigs soiling a portion of the food.

Pigs running on pasture, being in more natural conditions, are less liable to suffer from disease than are animals kept in sties that too often are dirty and insanitary. Indeed, when one sees the filthy conditions under which numbers of pigs are still kept, one is surprised, not at the high, but rather the low, mortality that frequently occurs. Further, pigs in the open can be handled and fed more economically than when they are housed, and another advantage is that when they are running in the open their manure is spread evenly over the ground.

In one of the tests at Boolara it was ascertained that short pasture was giving better results than was to be had from longer and seemingly richer feed. A litter was removed from the short pasture and placed on the longer feed consisting of cow grass and lucerne 2 feet high, with the unlooked-for result that the average daily gain receded from 1.40 lb. to 1.12 lb. The total lack of grass made a very great difference; without pasture 571 lb. of grain was required to fatten each pig; when the pigs were running on fair pasture the quantity was only 420 lb.

Small as these tests were, I feel that they were very useful. The percentage of good pigs in Victoria is low. Unfortunately many of those consigned to factories will never be quite suitable for bacon. The tests carried out at Boolara have stimulated interest, which has resulted in a number of good pigs being introduced there.

A Bacon Type of Pig Essential.

It is a matter for great regret that of the enormous amount of pig products annually imported into Great Britain Australia supplies only a few thousand pounds' worth. Some of the difficulties which prevent us from obtaining a full share of the market may be insurmountable, but an improvement in quality is not insurmountable, and the quality of our bacon must improve before we can hope to win any great share of the London market.

There should not be any difficulty in increasing local consumption, and if one can judge from complaints of curers and consumers, their main complaint is the lack of bacon of prime quality.

On most dairy farms pig-rearing should be a valuable adjunct to dairying, but the pigs must be of the right type. In several cases that have come under notice it has meant the difference between success and failure.

Pure breeding, particularly with the boar, is essential if the mongrel is to be eliminated. A system of grading would help the industry considerably by making unprofitable the rearing of unsuitable pigs.

At the present time a large number of pigs are purchased on dressed weight at a flat rate irrespective of quality. Curers admit that such a system is bad, but they say that anything like a sufficient quantity of bacon pigs cannot be purchased, and they must take what is offered. It is, indeed, unfortunate that many people who are rearing pigs unsuitable for the bacon trade are lowering prices, and thus doing a serious injury to the industry.

III.—Conducted at the Farm of Mr. F. McIvor, Boolara.

No. 1 Lot—Mixed Feed Test.

Litter of pigs born 26th March, 1929. Tamworth Berkshire cross. Sold as porkers. Fattened in paddock. Pollard and milk fed in trough.

Numbers.					Date of Weighing.		
					7th June.	10th July.	20th July.
					lb.	lb.	lb.
14	..	..	..	..	30	72	97
15	..	..	..	..	37½	73	97
16	..	..	..	..	30½	71	90
19	..	..	..	..	21	59	83
23v	..	..	..	..	23	61	85
23	..	..	..	..	29½	71	94
24	..	..	..	..	22½	66	88
25	..	..	..	..	31	73	91
Total					225	546	725
Age at date of weighing					73 days	106 days	125 days
Average weight					28·1 lb.	68·2 lb.	90·6 lb.
Period between weighing					..	33 days	19 days
Average gain between weighing dates					..	40·1 lb.	22·3 lb.
Average gain daily					..	1·21 lb.	1·17 lb.

	£	s.	d.	£	s.	d.
Amount received for eight porkers—total dressed weight						
480 lb. at 8½d. per lb.	..	..	..	..	17	11 0

Food consumed—

Pollard	..	1,514 lb. at 1d. per lb.	..	6	6	2
Barley	..	126 lb. at 1d. per lb.	..	0	10	6
Milk	..	261 gals. at 2d. per gal.	..	2	3	6
					9	0 2
Profit	..	..	..	8	10	10

DETAILS OF FOOD REQUIRED.

Cost of fattening each pig (including skim milk)—£1 2s. 6d.
 Food consumed per pig—205 lb. grain material, 326 lb. skim milk (53 days).
 Food eaten per pig daily—3·8 lb. grain material, 6·1 lb. skim milk.
 Average gain per pig daily—1·19 lb.
 Food required for 1 lb. pork—3·4 lb. grain material, 5·4 lb. skim milk.
 Cost per lb. of pork—4½d.

V.—Conducted on Farm of Mr. R. Halliday, Boolara.

No. 1 Lot—Mixed Feed Test.

Fattened in paddock in which pasture was very short. Fed in self-feeder. Litter of pigs born 31st March, 1929. Large York boar. Tamworth sow.

Numbers.	Date of Weighing.				
	6th June.	10th July.	7th Aug.	12th Aug.	12th August. Dressed Weight.
	lb.	lb.	lb.	lb.	lb.
7	55½	105	164	178	121
8	64½	113	171	178	121
9	60	115	173	183	126
10	60	109	168	174	117
11	62	115	179	193	136
12	32	75	131	140	95
Total weight..	334	632	986	1,046	716 at 8½d. per lb. = £26 2s. 1d.
Age at date of weighing ..	67 days	101 days	129 days	134 days	
Average weight ..	55·8 lb.	105·33 lb.	164·33 lb.	174·34 lb.	..
Period between weighing ..	..	34 days	28 days	5 days	..
Average gain between weighing dates ..	..	50 lb.	59 lb.	10 lb.	..
Average gain daily	..	1·47 lb.	2·10 lb.	2 lb.	..

Amount received from sale of six pigs—716 lb. at 8½d. per lb. £ s. d. .. 26 2 1

Food consumed—

Pollard ..	929 lb. at 0·95d. per lb.	..	3 13 5
Wheat (ground) ..	307 lb. at 1·10d. per lb.	..	1 8 1
Barley (ground) ..	280 lb. at 0·90d. per lb.	..	1 1 0
Meggitt's meal ..	9½ lb. at 2d. per lb.	..	0 1 7
Maize ..	5 lb. at 1d. per lb.	..	0 0 5
Skim milk ..	204 gals. at 2d. per gal.	..	1 14 0

7 18 6

Profit 18 3 7

DETAILS OF FOOD REQUIRED.

Food consumed per pig—255 lb. grain mixture, 340 lb. skim milk, in 67 days.

Cost of fattening per pig—£1 6s. 5d.

Food eaten per pig daily—3·31 lb. grain mixture.

Gain per pig daily—1·85 lb.

Food required for 1 lb. pork—2·14 lb. grain and 2·85 lb. skim milk.

Cost per lb. of pork—2·67d.

VI.—Conducted on Farm of Mr. R. Halliday, Boolara.

No. 2 Lot—Mixed Feed Test.

Litter of pigs born 24th June, 1929. Large White boar. First cross Berkshire and Tamworth sow.

Numbers.	Date of Weighing.			
	2nd Sept.	1st Oct.	1st Nov.	26th Nov. Dressed Weight.
	lb.	lb.	lb.	lb.
49	66	102	137	121
13	64	103	138	125
51	73	108	144	139
52	76	118	153	144
53	40	82	118	111
54	58	100	132	119
55	70	114	146	130
56	69	111	144	140
57	73	118	155	148
58	65	105	143	133
59	65	108	142	128
Total weight	719	1,169	1,552	1,438
Age at date of weighing	70 days	99 days	130 days	146 days
Average weight	65.36 lb.	106.27 lb.	141.10 lb.	130.7 lb.
Period between weighing	..	29 days	31 days	25 days
Average gain per pig between weighing dates	..	40.90 lb.	34.81 lb.	46.9 lb.
Average gain daily	..	1.40 lb.	1.12 lb.	1.80 lb.

		£	s.	d.	£	s.	d.
Amount received from sale of eleven pigs—1,438 lb. (dressed weight)						47	6 0
Food consumed—							
Pollard .. 4,036 lb. at 1d. per lb.			16	16	4		
Ground wheat .. 195 lb. at 1½d. per lb.			1	10	3		
Ground barley .. 152 lb. at 1d. per lb.			0	12	8		
						18	19 3
Profit			28	6	9		

In addition to the grain a total of 2,016 gallons of skim milk was fed.

DETAILS OF FOOD REQUIRED.

Food consumed per pig—398 lb. grain mixture, 1,830 lb. skim milk, in 76 days.
 Cost of fattening each pig—£3 5s., including skim milk.
 Food eaten per pig daily—3 lb. grain mixture, 24 lb. skim milk.
 Average gain per pig daily—1.44 lb.
 Food required for 1 lb. pork—3 lb. grain mixture, 14 lb. skim milk.
 Cost per lb. of pork—5.9d., including skim milk.

VII.—Conducted on Farm of Mr. R. Halliday, Boolara.

No. 3 Lot—Mixed Feed Test.

Litter of pigs born 14th August, 1929. Large white boar. Berkshire and Middle York cross sow.

Numbers.	Date of Weighing.					
	15th Oct.	1st Nov.	25th Nov.	6th Jan.	29th Jan.	4th Feb.
	lb.	lb.	lb.	lb.	lb.	lb.
61	36	56	82	130	160	167
62	40	60	75	135	173	183
63	38	61	97	160	199	209
64	47	67	98	163	200	210
65	41	54	83	146	181	189
66	41	66	75	140	180	190
67	35	53	70	115	152	155
1	37	56	86	145	187	187
2	40	59	83	139	178	190
Total ..	355	532	749	1,273	1,610	1,680
Age at date of weighing ..	61 days	78 days	102 days	145 days	168 days	173 days
Average weight ..	39·44 lb.	59·11 lb.	83·22 lb.	141·44 lb.	178·8 lb.	186·7 lb.
Period between weighing ..	..	17 days	24 days	43 days	23 days	5 days
Average gain between weighing dates ..	..	19·67 lb.	24·11 lb.	58·22 lb.	37·44 lb.	8·7 lb.
Average daily gain ..	..	1·15 lb.	1·0 lb.	1·35 lb.	1·62 lb.	1·74 lb.

	£	s.	d.	£	s.	d.
Amount received from sale of nine pigs—dressed weight, 1,168 lb.	..	..	..	..	36	14 4
Food consumed—						
Pollard .. 1,730 lb. at 1d. per lb.	..	7	4 2			
Meat meal .. 12 lb. at 2d. per lb.	..	0	2 0			
Ground barley .. 587 lb. at 1d. per lb.	..	2	8 11			
Dried brewers' grains 582 lb. at 1d. per lb.	..	2	8 6			
Crushed wheat .. 142 lb. at 1½d. per lb.	..	0	14 9			
Maize meal .. 234 lb. at 1½d. per lb.	..	1	8 5			
Pea meal .. 273 lb. at 1½d. per lb.	..	1	8 5			
					15	15 2
Profit	..	..	..		20	19 2

In addition to the grain a total of 1,787 gallons of skim milk was fed.

DETAILS OF FOOD REQUIRED.

Food consumed per pig—395 lb. grain mixture, 1,985 lb. skim milk, in 112 days.
 Cost of fattening each pig, including skim milk—£3 8s. 1d.
 Food eaten per pig daily—3·5 lb. grain, 17·7 lb. skim milk.
 Average gain per pig daily—1·31 lb.
 Food required for 1 lb. pork—3·04 lb. grain, 15·3 skim milk.
 Cost per lb. of pork—6·2d., including skim milk.

TONGALA IRRIGATED FARM COMPETITION, 1929-30.

Report of the Judges, L. C. Bartels, B.Ag.Sc., Department of Agriculture, and E. Rankin, State Rivers and Water Supply Commission.

Interest in the Irrigated Farm Competition at Tongala was well maintained in the 1929-30 season, and the condition of the blocks inspected shows that the settlement has many progressive farmers. Every entry had some praiseworthy features, and without detracting from the merit of the prize-winners, it may be said that the points scored by some of the other competitors were low only because of their failure to score in one section. Most of the entries were dairy farms, but a few of the farmers competing were grazing sheep. In only one case was fruit-growing a major activity, although the conditions of the competition were designed to provide for all classes.

Tongala is noted for the high standard of its dairy herds. Jerseys and Friesians are the main breeds, and on practically every farm a Jersey or Friesian bull is at the head of the herd. The resultant infusion of good blood will be a big factor in the future development of dairying in the district.

Messrs. Archibald, Coombes, and Gread have some of their Jerseys in the Government herd test. Mr. Rothwell's herd includes pure Guernseys, and Mr. Tinning has several pure Friesians.

Some Excellent Pastures.

In most cases where sheep are carried, they are on agistment, and splendid results are obtained with flocks on lucerne where a rotation in grazing, is maintained. Mr. L. Moulden, on a farm of 100 acres, was carrying 1,500 sheep. At one period, Mr. Woollard had 1,000 on 40 acres. Mr. G. Baul shows what can be done on a small block. Mr. Whitfield combines sheep and cows; his flock includes a small stud of Border Leicesters.

Mr. H. Hanslow, who is a sheep-breeder, gets good returns by intensive farming. He has 65 acres under lucerne, and aims at re-sowing about 10 per cent. of this every year. He always cultivates the lucerne in autumn, and applies one bag of superphosphate per acre, often sowing a cereal crop in the lucerne—in the autumn, a bushel of oats, or in the spring 10 to 15 lb. of Sudan grass per acre. Twenty-five acres of his block was in Sudan grass during last summer, and some of the lucerne was thickened up with this sorghum. He sowed different paddocks progressively; one 5-acre section carried 500 sheep for twelve and a half days; and on another area of 6 acres 475 sheep were grazed for three weeks.

In re-establishing the lucerne, a succession of oats, Sudan grass, oats, Sudan grass is adopted after ploughing up the old stand. A bag of superphosphate is sown with each crop. The Sudan grass stubble is easily cultivated out, and the land graded. The lucerne is sown in autumn, and the condition of some of the new lucerne testifies to the value of the method.

WHITE CLOVER, STRAWBERRY CLOVER, RYE GRASS.

The area under mixed pastures in the Tongala irrigation district shows a big increase since last season, and most dairy farmers acclaim their value. This augurs well for the future, because it is safe to say that the pastures will at least maintain their productivity, and there is every possibility that they will improve, because in the early stages the plant community in the pasture mixture is settling down, and there is a development of regional strains of grasses and clovers. In this connexion, white clover must again be mentioned. Through the irrigation districts it shows a wonderful adaptability, and a wild white clover of a very hardy type is spreading rapidly, particularly in declining lucerne stands. It is at its best in soils which absorb water readily, but it shows a readiness to grow on heavier soils if watered and manured regularly. One of the entrants in the pasture competition was Mr. Foley, at Tongala. He has a patch of this white clover which has developed in an old lucerne paddock, and he estimates the carrying capacity of a 4-acre, paddock subdivided into two, to be at the rate of four cows to the acre between October and March inclusive.

Strawberry clover is also on the increase. Slower to spread than white clover, it seems to establish itself more firmly, and there is no doubt that, in years to come, it will be an important constituent in irrigated pastures. The wide range of conditions under which it grows, its ability to withstand dryness as well as to luxuriate in water, and its tolerance for a fair degree of salinity in soil, make it well adapted for irrigation conditions. It is not usually conspicuous for the bulk of growth except where it is protected, as stock graze it down closely. Settlers sowing pasture should include a few ounces of strawberry clover seed per acre, or establish it by planting roots. It may be stated that, at Swan Hill, Myall, and Cohuna, distinct types of superior character are spreading naturally.

The experience of most irrigation farmers is that rye grass thins out till it occupies a minor part in the pasture. There are notable exceptions, and Mr. G. Duck, at Tongala, has pastures where a good balance of rye grass and white clover is maintained. Mr. Duck pays careful attention to watering, and manures regularly. He always has an abundance of feed, and his pastures are never grazed closely, but that he has a persistent strain of rye grass is shown by the fact that it has spread into paddocks where it was not sown. Originally he sowed a mixture of Western District and New Zealand rye grass, both the product of years of natural selection under Australasian conditions; so that the failure of rye grass to remain may be ascribed to the fact that the best strains are not always available for sowing. There is hope that suitable strains will develop, and in some districts self-sown rye grass is invading the paddocks. This applies to Cohuna, and it has been noticed at Werribee; but examination shows that some of it conforms more to Italian rye in type.

Cocksfoot has shown a ready ability to adapt itself to irrigation conditions, and its inclusion helps to preserve the balance. When kept down, it is eaten by stock, but they do not relish it if it is allowed to get coarse.

Subterranean clover was beginning to make good growth at the second inspection. It was at its best where the paddocks were rested during the summer—in mixtures it was becoming prominent as the white clover declined with the advance of autumn.

White clover, strawberry clover, and subterranean clover must be regarded as the permanent clovers in the pasture mixture usually sown. Perennial red clover and Alsike clover provide useful feed for three or four years during the early life of the pastures. Lucerne, too, may be a valuable constituent. These three elements are handicapped to some extent by heavy grazing.

Paspalum distichum is common in many pastures in the Goulburn Valley, and grows freely in the wetter patches.

Convincing proof of the value of mixed pastures is furnished by a few settlers at Tongala who kept careful records of the stock carried. One farmer agisting sheep calculated that the grazing fees from an area of pasture from the beginning of October, when the sheep were first put on, to the end of February, was £16 per acre. This was more than confirmed by Mr. T. Gass, of Koyuga, who submitted figures attested by the butter factory manager to show that 4 acres of mixed pasture from 5th October to mid-February, gave him 320 "cow days" per acre, and returned him in actual sales of milk £21 6s. per acre.

Mr. Gass grazed 32 head of cattle (28 milking cows, 3 dry ones, and a bull) on the 4 acres. There were five grazing periods, viz.:—October, 13 days; November, 9 days; December, 6½ days; January, 7 days; February, 4½ days—totalling 40 days.

The milk produced during the time when the cows grazed the pasture totalled 2,997.5 gallons, or 749 gallons per acre. The butter-fat test of the milk was 3.6 per cent., giving 269 lb. of butter-fat per acre; the average price of 1s. 7d. per lb. made the return of £21 6s. per acre. Mr. Gass said that his herd showed an advance of 10 gallons of milk per day when moved from lucerne to pasture.

Comments on Winning Farms.

The general excellence of Mr. F. W. Brose's farm—recorded last year—was maintained, and his farm was again awarded the prize. The main features were the same. He has 62 acres, divided into sixteen paddocks, and the 2 acres occupied by the house, garden, and yards. Two of the paddocks are subdivided into pig-yards. The block has 42 acres of lucerne and 13 acres of mixed pasture; 1½ acres had been in oats, and 1½ acres bore an excellent crop of imphee. The lucerne looked healthy; small "drowned-out" areas had been resown with Italian rye grass and Alsike clover. On the average, Mr. Brose uses 18 inches of irrigation water, and applies 2 cwt. of superphosphate per acre to the bulk of the area.

His dairy herd consisted of 23 cows, 7 heifers, and 1 Jersey bull. He had severely culled his herd since last year. Thirty Black Orpington hens are kept. Eleven brood sows were carried; six of these were pure Tamworth and five Berkshire-Tamworth crossbreds. A Duroc Jersey boar and a young Duroc Jersey sow are to be the foundation of a herd of that breed. Last year the progeny of ten sows returned £243.

Details of Awards in Farm Competition. (AVERAGE OF TWO INSPECTIONS.)

Name of Competitor.	General Layout of Ground for Irrigation and Handling, Dairy, Sheep, Orchard.	Percentage of Land under Cultivation.	Returns from Produce of Farm and Stock or Trees.	General Control of Water, including State of Irrigation Channel.	Dairy-men or Sheep Farmers—(Conservation of Fodder.	Orchardists—Provision of Green and Artificial Manure.	Dairy-men or Sheep Farmers—Poultry and Pigs.	Orchardists—(Cultivation and Care of the Orchard.	Fences.	Farm Building.	Freedom from Weeds.	Care of Implements.	General Appearance of Surroundings or Dwelling.	Total.
Possible Points	50	40	30	30	30	30	30	30	20	20	20	15	15	360
1. Brose, F. W...	45½	36½	25	27	28	..	23	..	19	18½	19	13½	14	269
2. Makin, P. ..	42	36½	28	27½	..	25	..	26	18	16½	18	11	13	261½
3. Duck, G. ..	40	38	29	25	29	..	17	..	18	17	17½	12	12	254½
4. Rowley, A. W.	45	35	25	24	29	..	20	..	18	16	18	10½	9½	250
5. Rothwell, S. ..	45½	32½	25½	22½	26½	..	24½	..	18	17	18	10	8½	248½
6. Gread, W. J.	43½	31½	26	25	28	..	19½	..	19	17½	18	9½	8	245½
7. Whitfield, W.	44½	34	25	25½	28	..	20	..	19	13	15	10	11	245
8. Bullingham, J.	45	36	27½	25½	29	..	11½	..	18	15	17	9	10	243½
9. Gass, T. ..	40	36	27	27	30	..	17½	..	18	10	18	9	9	241½
10. Davis, A. R.	42½	30	24	23	27	..	21	..	16½	17	16	13	10½	240½
11. Hanslow, H.	40	39	26½	26	29	..	..	..	17	19	18	14	10	238½
12. Archibald, —.	42	33½	28½	20	27	..	18	..	16½	15	16	9	12	237½
13. Tinning, W. ..	41	29½	27	22½	26	..	13	..	18	18	17	12	9	233
14. Fuller, S. ..	43½	34½	24½	20½	25	..	17	..	17	13½	14	10	10	229½
15. Woollard, C.	40	34	24	24½	20	..	10	..	16½	17	18	13	12½	229½
16. Coombes, T. ..	43	27½	25½	20½	26½	..	14	..	18	16	15	9½	7	222½
17. Caldecott, R.	45	34	25	25	15	..	5	..	18	16	16	11½	10	220½
18. Baul, G. ..	40	34½	25	23	6	..	18	..	18	18	18	9	6	215½
19. Moulden, L.	40	36½	28	26	..	..	8	..	16½	12	17	8	11	203
20. Willmer, L. T.	42½	25	24	21	27	..	..	..	19	10	17	6	5	196½

The general appointments of Mr. Brose's house and farm buildings were very good. A very neat flower garden and small orchard were attractive features. The milking shed and milking plant were clean, while a bull-yard, implement-shed, tidy pig-styes, and two well-built stacks of hay all helped to earn good points.

Mr. Makin has a block of 75 acres, 30 acres of which is an orchard. He has 27 acres of lucerne and 10 acres in seeded pasture. He sold his cows in 1927, and now grazes sheep. The area carried 350 lambs and 202 comeback ewes with 30 lambs during the summer season. The pastures received two bags of superphosphate per acre, and the lucerne was given a bag per acre in spring. The orchard and vineyard were particularly clean, and the trees and vines looked healthy. A nice flock of poultry was a promising side-line.

Mr. G. Duck's farm is one of the show blocks of the Tongala district. He has an area of 68 acres, subdivided into twelve paddocks. This includes 12 acres of lucerne and 19 acres of sown pasture. The remainder of the area, excluding the farmstead, has good self-sown rye grass and white clover. Mr. Duck uses 120 acre-feet of water, and applies 200 lb. of superphosphate each year. He is milking 23 cows, including eight heifers, and has also a Friesian bull and 27 young stock, besides 5 horses. For the last four years he has obtained top returns at the cheese factory, and last year seventeen cows returned £560 in payments for milk. In addition, a bonus of £6 14s. was received from the factory. It should also be mentioned that ten "poddies" were reared; each of them was fed on new milk for ten weeks.

LUCERNE COMPETITION.

The winning crop in the lucerne competition nearly attained perfection, and stood out in a number of excellent exhibits. The value of lucerne on irrigated blocks was very well demonstrated, and, despite the growing appreciation of mixed pastures, farmers should realize fully the value of lucerne and the possibilities it offers under good methods of handling. Much improvement in lucerne cultural methods has taken place in late years, and Tongala farmers have been receptive of the new ideas. Top-dressing is general, and in that fact one finds an explanation of the records of production and carrying capacity which are so striking. It is reflected in the appearance of the lucerne stands, the freedom from weeds, the prolonged life of the stands, the better winter growth, and the general health of stock. The tendency is to be more liberal in the use of manure.

The lucerne manurial tests conducted for the Irrigation Investigations Committee by Mr. J. Bullingham, at Tongala, have had a big influence in furthering the extension in top-dressing. They give a very convincing demonstration of the effect of superphosphate which becomes more marked as the years go on. When one notices the scanty growth on the unmanured lucerne, it is hard to realize that it is a measure of the production common on many blocks a few years ago, and it indicates what a hopeless task confronts the man on a small block who does not top-dress.

Irrigation Practices.

It must be conceded also that a more intelligent use of water is evident, but there is room for improvement. It was obvious that many of the district crops had not received sufficient water to enable the best growth to be attained. Sometimes it is expedient to withhold water from lucerne, and the ability of this crop to withstand dryness is a very important feature; but the condition referred to arises from the fact that the Goulburn Valley soils do not in all cases take water readily, and regular and close attention to watering is necessary. The common practice of watering without regard to the amount applied makes the results dependent on the porosity of the soil, and, because clay loams will not absorb the water readily, the growth on such soils is scanty. Considerable improvement will be effected if supplementary waterings are given. This improvement is progressive, because, with the better penetration of water, better root development is made, and this has a subsoiling effect. This advice must be acted upon with discretion, and the temptation to augment yields on the sandy loams by frequent waterings may lead to waste and injurious results; nor must the advice to give extra waterings on heavier soils be read without regard to the danger from water lying on such soils.

While one hesitates to suggest extra work in irrigating, which is at any time an irksome task, it is true that full results are not obtained on many farms because the water applied is inadequate.

Comments on Crops in Lucerne Competition.

Mr. E. Pankhurst showed a wonderful crop of lucerne, which gave promise of a yield of 35 cwt. per acre or more. It was uniform and clean, and just approaching the best condition for cutting. The exhibit was 9 acres in area, and was in its second year of growth. The land had been ploughed in 1928; broken down, graded, and sown in August with 7½ lb. of Hunter River seed and a bag of superphosphate per acre. The seed was drilled in 2 inches deep. The young crop was grazed in October and twice afterwards in the first season. It was watered four times in the 1928-29 summer. A bag of manure was applied in 1929, and the first crop was eaten off in August. Later crops were mowed, and the fourth was the one submitted for inspection in the competition. Two waterings between cuttings were given to the paddock.

Mr. G. Baul's lucerne was placed second, and his exhibit was a very good one. Contributory causes to its excellence were the liberal use of superphosphate and the attention paid to watering.

Mr. Bullingham's lucerne had made very heavy growth over the greater area, but still was rather irregular. It was sown in August, 1924, on lea ground; 8 lb. of seed was put in, with 100 lb. of superphosphate per acre. It now receives an annual dressing of 250 lb. of superphosphate, and is watered every ten days in summer.

Details of Awards in Lucerne Competition.

Name of Competitor.	Lay-out of Ground for Irrigation—Condition of Channels.	Estimated Yield at Time of Judging.	Quality of Hay Crop Would Produce.	Uniformity of Stand.	Freedom from Weeds.	Total.
Possible Points ..	20	20	20	20	20	100
Pankhurst, E.	19	20	20	19	19½	97½
Baul, G. ..	18	17	20	19	19½	93½
Bullingham, J.	19	19	19	17	19	93
Meldrum, A. ..	18	19	18	14	19	88
Graham, W. G.	19	14	18	16	18	85
Burberry, A. R.	18	15½	18	14	19	84½
Davis, A. R. ..	18	11½	20	16	18	83½
Caldecott, R.	18	12½	19	15	19	83½
Whitfield, W.	18	15½	15	17	18	83½
Moulden, L. ..	19	8½	17	18	19	81½
Tinning, T. H.	19	3	10	14	19	75
Baker, F. ..	17	3	17	17	17	71

IRRIGATED PASTURE COMPETITION.

Mr. T. Coombe's pasture entry was 4½ acres in area. It was the same exhibit as was awarded first prize last year, and it showed improvement. At both inspections it was in excellent condition. White clover was spreading well, and rye grass and cocksfoot were thick. It was a uniform pasture, and there was very little weed growth. It was sown in May, 1928, after the ground had been well prepared. The mixture put in was—rye grass, 20 lb.; cocksfoot, 5 lb.; white clover, 2 lb.; red clover, 2 lb.; Alsike clover, 1 lb.; and subterranean clover, 1 lb. The area is top-dressed annually with a bag of superphosphate per acre, and is watered every fortnight. In the hottest spell of the season one watering period was missed; consequently the pasture was checked, but soon recovered. It has been grazed very heavily with cows and sheep.

Mr. T. Gass showed an area of 4 acres of pasture. This was sown in 1927. During last year it received two bags of superphosphate and one bag of sulphate of ammonia per acre. Mr. Gass grazes at monthly intervals, and to some extent this was responsible for a rather "open" condition in the pasture and the prominence of lucerne. He irrigates every fortnight, and the ground requires 3 to 3½ inches of water. The record of grazing is given elsewhere in the report.

Mr. Watson's pasture was in good condition, with the clovers prominent, but it lost points owing to slight irregularities. The paddock was 7 acres in area, and had been sown in 1928 with 120 lb. of superphosphate per acre, but in 1929 it was top-dressed with a bag in March and a bag in November. Mr. Watson waters the pasture every ten days. He has had splendid results, and is very satisfied. For a great part of the summer season the paddock was grazed during alternate weeks, and carried 19 to 22 cows.

Details of Awards in Irrigated Pasture Competition.

Name of Competitor.	Lay-out of Paddock for Irrigation, Condition of Channels, &c	Condition of Pastures.	Uniformity.	Variety.	Absence of Weeds.	Total.
Possible Points ..	20	20	20	20	20	100
Coombes, T. A.	19	19	19	19	19	95
Gass, T. ..	18	18½	18	19	19	92½
Watson, E. ..	18½	18	17	19	19	91½
McCluskey, T.	18	17½	17½	18	18½	89½
Davis, J. ..	18½	17½	17½	19	17	89½
Shipley, C. ..	17½	17½	18	18	18	89
Grigg, H. G. ..	18½	18	18	18½	16	89
Duck, G. ..	16	18	17	18	18	87
Foley, C. (A) ..	17½	17½	17½	18	16½	87
Caldecott, R.	17½	18	18	17½	16	87
Foley, C. (B) ..	17	15	18	18	18	86
Roberts, A. ..	16	15	17	18	18	84
Willmer, L. T.	17	16½	14	19	17	83½
Baker, F. ..	18	13	16	18	18	83
Everett, W. ..	14	17	16½	17½	17	82

KERANG FALLOW AND CROP COMPETITIONS, 1929.

Report of the Judge, A. B. Hackwell, B.Ag.Sc., Science Field Officer.

The Kerang wheat-growing district in which the local fallow and crop competitions were conducted, extended to the west and south-west of the township. Although many of the farmers experienced a lean year in 1929, the district as a whole was more fortunate than many other older centres throughout the wheat belt. The varying rainfall within the district, and the varying types of land, were mainly responsible for the wide difference in the standard of the competition crops. Many of the crops inspected were very creditable. A number suffered through lighter rainfall, or were sown on heavier ground to which the dry conditions were extremely unsuitable. The crops on heavy flats had almost completely failed, except in scattered crab holes.

Take-all.

The most popular varieties in the district appeared to be Rance, Free Gallipoli, Federation, and Penny. Deadheads were present in many crops; in some they were very common. These are caused by Take-all and allied forms of foot-rot disease which attack the wheat plants on the roots or lower portions of the stems, either in patches or in single plants scattered through the crop. When the plants are infected in the seedling stage they usually die and leave typical bare circular patches. Should such plants manage to subsist, or should other

plants be affected at a later stage they will usually appear as deadheads in the crop. In most cases the grains in the deadheads are formed, but become shrivelled and undeveloped as the roots, being diseased and stunted, are unable to absorb sufficient food for the grains to fill. It is probable that the disease is accentuated in an extremely dry season, under which conditions there are no doubt more plants in a weaker or more susceptible condition than in a normal year.

Take-all is encouraged in a paddock which is frequently cropped with wheat. The checking of this disease is assisted by a good clean burn of the wheaten stubble by sowing the wheat on a well-prepared early fallow, and by the growing of oats as a rotation. Dry and deep working of the fallow is considered to encourage the disease, and efforts should be made to keep the fallows free from barley grass, as Take-all can live on that plant.

The Crops.

The crops entered for competition were sown with an average of 66 lb. of seed and 91 lb. of superphosphate per acre. The manure ranged from 70 to 100 lb. per acre, and the rate of seeding from 60 to 75 lb.

The awards for the crops are as follow:—

CROPS—100 ACRES.

Competitor.	Variety.	Yield.	Purity and Type.	Absence of—		Evenness.	Total.
				Weeds.	Disease.		
Maximum Points ..		35	20	15	15	15	100
W. A. English ..	Free Gallipoli, Nizam ..	35	18	14	14	14	95
J. M. Hallinan ..	Rance ..	32	19	13	14	13	91
E. F. English ..	Rance ..	31	17	13	14	12	87
E. O. Manuel (1) ..	Gluyas ..	27	15	14	14	12	82
E. O. Manuel (2) ..	Rance ..	24	18	14	13	12	81
E. O. Manuel (3) ..	Penny ..	29	16	14	9	13	81
R. G. Shipp (2) ..	Penny ..	24	18	14	10	13	79
T. A. Kendall ..	Rance ..	16	18	13	13	13	73
Robertson Bros. (1)	Sepoy ..	13	18	13	12	12	68
H. F. Robinson ..	Free Gallipoli ..	16	17	11	13	10	67
Richard Shipp (1)	Federation ..	16	16	13	13	9	67
R. G. Shipp (1) ..	Rance ..	13	18	14	12	10	67
F. P. Murphy ..	Crops too light for classification						
Robertson Bros. (2)							
Richard Shipp (2)							

The winning crop grown by Mr. W. A. English in the Lake Meran district was even and very dense, and although at the time of judging had still to fill, it gave promise of yielding the heaviest in the competition. The local rainfall for 1929 from January to October inclusive registered 856 points, of which 449 points fell from June to October. Mr. English's crop was sown in mid-June with Free Gallipoli and Nizam; 65 lb. of dry-pickled seed and 90 lb. of superphosphate were applied per acre. The area of heavy-red sandy loam, had been summer-

fallowed in February with a scarifier, cultivated in April, scarified in June, scarified and cultivated in October, cultivated and harrowed in April, scarified and harrowed in June before sowing.

Mr. J. M. Hallinan's crop of Rance obtained second place with 91 points. A good yield was expected, as the crop was fairly even and the heads remarkably well filled. The area had been sown in mid-May with 60 lb. of dry-pickled seed and 90 lb. of superphosphate per acre. The local rainfall from May to October inclusive amounted to 352 points, and from January to October 635 points. The paddock had been broken up with a mould-board plough in June, harrowed in July, scarified in August, spring-toothed in September and twice in October, harrowed in October, spring-toothed in April, and scarified early in May.

Mr. E. F. English exhibited a splendid crop that had been sown on a recently cleared heavy box flat. It contained patches of the densest and heaviest crop inspected, but was uneven throughout. It had been sown with 75 lb. of dry-pickled seed and 90 lb. of superphosphate per acre. Points were lost for the presence of strangers and for patches of weeds.

AGGREGATE POINTS—FALLOW 1928 AND CROP 1929.

Competitor.					Fallow, 1928.	Crop, 1929.	Total.
Maximum Points					100	100	200
J. M. Hallinan	..	..	..	..	90	91	181
W. A. English	..	..	..	..	83	95	178
E. O. Manuel (1)	..	..	..	..	92	82	174
E. O. Manuel (2)	..	..	..	..	92	81	173
R. G. Shipp (2)	..	..	..	..	92	79	171
E. O. Manuel (3)	..	..	..	..	87	81	168
E. F. English	..	..	..	..	76	87	163
R. G. Shipp (1)	..	..	..	..	92	67	159
H. F. Robinson	..	..	..	..	88	67	155
Robertson Bros. (1)	..	..	..	..	85	68	153
T. A. Kendall	..	..	..	..	79	73	152
Richard Shipp	..	..	..	..	84	67	151

* Points for fallows awarded by Mr. C. H. James, 1928.

In the aggregate for fallow 1928, and crop 1929, Mr. J. M. Hallinan obtained 181 points, Mr. W. A. English next with 178 points, and Mr. E. O. Manuel's No. 1 entry 174 points.

Fallows.

The advantage of early thoroughly-worked fallow is generally recognized in the Kerang district. The scarcity of rain in 1929 presented few opportunities for the preparation of the fallow, and there was a wide variation in the quality of the thirteen entries inspected. It was apparent that the farmers who submitted the best fallows had made every use of the limited opportunities. Some farmers, however, were handicapped because of lighter rainfalls or of having to prepare heavier types of land to which the dry conditions were extremely unfavorable.

Awards.

FALLOWS—100 ACRES, 1929.

Competitor.	Moisture.	Mulch.	Absence of Weeds.	Cultivation.	Total.
Maximum Points	25	25	25	25	100
E. F. English (1)	24	24	23	23	94
C. Brady (1)	22	24	24	23	93
C. Brady (2)	21	23	24	22	90
E. F. English (2)	23	22	23	21	89
F. P. Murphy	20	22	21	23	86
R. G. Shipp (2)	19	22	24	21	86
R. G. Shipp (1)	20	20	24	21	85
R. G. Shipp (3)	19	19	21	22	84
T. A. Kendall	19	19	23	21	82
J. M. Hallinan	19	20	22	20	81
Richard Shipp	19	19	22	20	80
H. F. Robinson	18	18	23	18	77
E. O. Manuel	21	18	19	18	76

The winning fallow was exhibited by Mr. E. F. English, and obtained 94 points. The area was mostly heavy red-sandy loam, and showed a splendid mulch of good texture and even depth over a solid seed-bed that contained the highest moisture content of all entries. The paddock had been summer-fallowed with a scarifier in March, scarified late in May, scarified and lightly harrowed in July, and cultivated with a combine in October. A close second with 93 points was gained by Mr. C. Brady's No. 1 entry, of which a very creditable job had been made.

The area was mostly reddish-sandy loam with patches of sand and grey ground. The mulch had been worked down well, and the level seed-bed showed a good moisture content. The land had been broken with a scarifier early in July, spring-toothed across in August, and spring-toothed again in October.

Mr. C. Brady's No. 2 entry, which gained third place, contained less moisture than No. 1 entry, and the cultivation was not so even. It had received similar workings to No. 1, but had been scarified about a fortnight later.

NORTH-EAST MALLEE CROP COMPETITION, 1929.

(Pier Millan Local Competition and the H. V. McKay Competition at Kulwin, Pier Millan, and Chinkapook.)

Report of Judge, A. B. Hackwell, B.Ag.Sc., Science Field Officer.

Most of the fallow and crop competitions throughout the newer North-east Mallee were abandoned this season owing to the severity of the drought. In most of these districts only 4 to 4½ inches of rain was received from January to October. Under such disastrous conditions, the majority of the crops completely failed. Some centres in

a belt from Speed to Piangil, including most of Pier Millan and Chinkapook, were fortunately favoured with additional showers early in the year which stood to the benefit of the crops in a remarkable way.

The cool weather experienced during October and November was a compensating feature and enabled surviving crops to fill well, and in most cases, yield better than had been expected.

Despite the adverse season, a local crop competition was held at Pier Millan for the best 100 acres of crop grown on any fallow. This competition attracted seven entries, most of which were placed along the slopes of sandy rises which grew the best crops under the seasonal conditions.

In the H. V. McKay Cup Competition which extends over the period 1927-1930, eight crops and fallows were judged at Kulwin, Pier Millan and Chinkapook.

The crop entries in this competition were very uneven, being located on different types of fallow selected and judged in 1928. These areas withstood the drought conditions to a varying degree, the heavy flats having completely failed except in scattered crabholes.

The crops at Kulwin had been subject to even more unfavorable conditions than most of the entries at Pier Millan and Chinkapook. With the sparse rainfall in 1929, the preparation of good fallows was out of the question, and at the time of judging, several entries had not received even one cultivation after ploughing. Some of the areas fallowed had had the advantage on an extra shower or two of which full opportunity had generally been taken.

The awards and comments are as follow:—

PIER MILLAN LOCAL CROP COMPETITION, 1929. 100 ACRES GROWN ON FALLOW.

Competitor.	Variety.	Yield.	Purity and Type.	Absence of—		Evenness.	Total.
				Weeds.	Disease.		
Maximum Points ..		35	20	15	15	15	100
A. Vanderfeen, No. 1	Omrah.. ..	23	16	13	13	13	78
G. H. Rohde ..	Nabawa ..	20	18	13	13	12	76
A. Vanderfeen, No. 2	Joffre and Free Gal.	25	15	12	12	11	75
E. Daniell ..	Federation ..	16	16	12	12	14	70
S. F. Dickinson ..	Nizam and Hard Fed.	18	15	11	13	10	67
J. Crosbie ..	Currawa, Rance, Joffre	16	15	12	12	10	65
D. K. Fletcher ..	Currawa, &c. ..	15	14	11	13	10	63

Mr. A. Vanderfeen's entry of Omrah gained highest points. It had been sown with a combine on an area of summer fallow during the first week of June with 60 lb. of seed pickled with formalin, and 70 lb. of superphosphate per acre. The rainfall on Mr. Vanderfeen's farm in 1929, from April to October inclusive, totalled 538 points, of which 282 fell in April. This winning crop had not been tipped, and was fairly thick and even, and at the time of judging gave promise of a

comparatively good yield, although, at that stage, the grain had not completed filling. Points were deducted as the heads were not uniform in type, and for the presence of an odd dead head and mustard plant.

Mr. G. H. Rohde's entry of Nabawa obtained second place and included a long sandy rise of fairly even crop, with the balance on the flats being thin and badly tipped. It had been sown in mid-May on winter fallow with 60 lb. of formalin pickled seed, and 60 lb. of superphosphate per acre. The crop was fairly pure, but the area as a whole was not so even as the winning entry, and did not promise to yield quite as heavily.

Third place was obtained by Mr. Vanderfeen's second entry sown on winter fallow in the first week of May with 50 lb. of seed and 60 lb. of superphosphate per acre. It was considered that this area would yield heaviest in the competition, but points were lost on the presence of strangers, dead heads, and mustard.

McKay Cup Competition—North-Eastern Mallee.

To be awarded to competitor obtaining highest aggregate points for 100 acres of crop grown 1928, 1929, and 1930, on judged fallow.

CROPS, 1929.

Competitor.	Variety.	Yield.	Purity and Type.	Absence of—		Evenness.	Total.
				Weeds.	Disease.		
Maximum Points ..		35	20	15	15	15	100
A. Vanderfeen ..	Omrah ..	23	16	13	13	13	78
G. P. Rohde ..	Nabawa ..	20	18	13	13	12	76
W. J. Gray, jun. ..	Free Gallipoli, Bald Early	25	18	11	10	11	75
J. P. Hogan ..	Rance ..	15	15	14	12	9	65
C. E. Barnham ..	Fed., Rajah, &c.	15	14	13	14	8	64
Barry Bros. ..	Free Gallipoli ..	9	19	14	14	8	64
J. F. Thomas ..	Nizam ..	7	18	13	13	10	61
C. W. Howley ..	Sepoy ..	14	15	10	9	10	58

FALLOWS, 1929.

Competitor.	Moisture.	Mulch.	Absence of Weeds.	Cultivation.	Total.
Maximum Points ..	25	25	25	25	100
W. J. Gray, jun. ..	21	22	23	21	87
C. E. Barnham ..	19	22	24	19	84
Barry Bros. ..	20	21	22	20	83
A. Vanderfeen ..	19	20	21	19	79
J. F. Thomas ..	14	20	24	18	76
G. P. Rohde ..	18	19	20	18	75
J. P. Hogan ..	14	19	23	17	73
C. W. Howley ..	16	18	22	16	72

Mr. Vanderfeen's crop of Omrah was also an entry in the McKay Cup Competition in which it gained highest points.

Mr. G. P. Rohde's entry of Nabawa was the same crop as that entered by Mr. G. H. Rohde in the Pier Millan Competition, and gained second place.

The crop entry of Mr. W. T. Gray, junior, of Chinkapook, comprised Free Gallipoli and Bald Early, and obtained third highest points. The area judged was uneven, but contained some of the densest crop inspected in the competition, as well as patches of poor crop badly infected with mustard. At the time of judging, it was expected that this entry would return the heaviest yield. The presence of ball smut in the Bald Early variety was a detracting feature.

Of the 1929 fallows, an outstanding entry was submitted by Mr. Gray, and gained highest points. The entry comprised two areas of pine ridge of red sandy loam that had been ploughed from wheaten stubble at the end of June, harrowed immediately, and spring-toothed in August. The foundation of a good fallow had been prepared showing an even and suitable depth of mulch, and a comparatively good moisture content.

Second place was obtained by Mr. C. E. Barnham's fallow at Chinkapook, which consisted mainly of grey sandy loam. It had been summer-fallowed with a combine at the end of March, ploughed with the mould-board late in June, and harrowed. Compared with the leading entry, this fallow lost points on consolidation of seed-bed and its moisture content.

Messrs. Barry Brothers (Chinkapook) entered a heavy mixed flat that had been summer fallowed with a mould-board plough in February, and scarified in mid-May. This entry gained third highest points.

McKay Cup Competition.

PROGRESS AWARDS.

Competitor.	District.	Fallow, 1927-28.	Crop, 1928.	Fallow, 1928.	Crop, 1929.	Fallow, 1929.	Progress Total.
Maximum Points ..		100	100	100	100	100	500
W. J. Gray, jun. ..	Chinkapook ..	82	89	90	75	87	423
A. Vanderfeen ..	Pier-Millan ..	86	84	91	78	79	418
Barry Bros. ..	Chinkapook ..	93	82	92	64	83	414
C. E. Barnham ..	" ..	92	80	87	64	84	407
J. F. Thomas ..	Kulwin ..	92	76	85	61	76	390
J. P. Hogan ..	" ..	77	88	86	65	73	389
G. P. Rohde ..	Pier-Millan ..	70	81	87	76	75	389
C. W. Howley ..	Chinkapook ..	73	84	87	58	72	374

In the Progress Awards to-date, Mr. W. J. Gray (Chinkapook) leads with 423 points, Mr. A. Vanderfeen (Pier Millan) is second with 418 points, and Messrs. Barry Brothers (Chinkapook) third with 414 points. This competition will be concluded after the judging of the 1930 crops.

WANGARATTA CROP AND FALLOW COMPETITION.

Crop Section.

Report of Judge, C. P. Goulding, B.Ag.Sc., Manager, State Farm, Rutherglen.

The standard of the crops which were inspected on the 25th and 26th of November was very high, and the excellent results obtained in such a dry season illustrate the effectiveness of thorough farming methods.

The rainfall in most of the district, during the growing period of the crop, was only about 10 inches, approximately two-thirds of that obtained in an average season. Probably the chief reason why such a light rainfall gave such good results was that its incidence was very favorable in that a saving shower usually came before the crops had shown much signs of wilting. It is a well established fact that relatively dry winters favour cropping in this district, most of the soils being very liable to become waterlogged in wet seasons.

Unfortunately a few of the crops were seriously affected by frost, those suffering the greatest loss being the crops of Messrs. Kay and McDonald and Sons, Tarrawingee.

The awards are as follow:—

Competitor.	Variety.	Apparent Yield.	Trueness to Type and Purity.	Evenness.	Freedom from Weeds.	Freedom from Disease.	Crop Total.	Fallow.	Aggregate.
Maximum Points		35	20	15	15	15	100	100	200
A. Sadler (2) ..	Major	25	19	14	14	14	96	93	189
I. Atkinson (2) ..	Nabawa	34	19	14	14	14	95	96	191
H. Klemm ..	Free Gallipoli, Major ..	33	20	14	14	13	94	96	190
I. Atkinson (1) ..	Free Gallipoli ..	32	20	14	14	13	93	97	190
A. Sadler (1) ..	Free Gallipoli ..	32	20	13	14	13	92	96	188
T. O'Keefe (1) ..	Free Gallipoli ..	28	19	14	15	14	90	91	181
W. B. Richardson ..	Free Gallipoli, Austin ..	26	19	14	14	13	86	94	180
T. O'Keefe (2) ..	Waratah	26	18	14	13	14	85	92	177
N. Sandford ..	Free Gallipoli ..	23	17	14	13	12	79	92	171
Kay & McDonald (1)	Baldmin	16	19	14	14	14	77	88	165
Kay & McDonald (2)	Baldmin	16	19	13	13	14	75	89	164
McDonald & Sons ..	Baldmin	9	18	15	14	14	70	91	161

POULTRY DISEASES.

II.—COCCIDIOSIS IN THE FOWL.

*By Harold E. Albiston, D.V.Sc., Veterinary Research Institute,
University of Melbourne.*

Coccidiosis is primarily a disease of the intestinal tract, although in chickens the liver may occasionally be affected, and geese sometimes show signs of the disease in the kidneys. The disease has also been found in ducks, turkeys, and pigeons. From a practical point of view, however, Coccidiosis is most important when it occurs among chickens.

The majority of the minute microscopic organisms associated with the causation of infectious disease belong to two main classes, namely, the *bacteria* and the *protozoa*. The bacteria represent the lowliest forms of plant life; the protozoa, on the other hand, are generally regarded as the lowest forms of animal life. Microscopic in size, they have bodies consisting of a single cell, and they frequently exhibit a complicated life cycle, or process of reproduction. To the group of protozoa belong the *Coccidia*, which cause the disease known as Coccidiosis.

SUSCEPTIBILITY.

All birds, whether wild or domesticated, may contract Coccidiosis if exposed to infection. As with many other diseases, the ravages of Coccidiosis become more serious when it appears among birds kept in confinement. Geese, turkeys, and ducks on free range are rarely affected in large numbers, although an occasional isolated case may occur from time to time. When Coccidiosis makes its appearance among birds kept in close confinement, the result is generally very serious, and the disease frequently assumes enzootic proportions.

AGE INCIDENCE.

Coccidiosis is most serious when it occurs among young birds. Growing chickens are particularly susceptible to infection, but as maturity is approached, a considerable degree of natural resistance is manifested.

It is only when adult birds become grossly infected, or their resistance weakened through some other cause, that they suffer from Coccidiosis. In fact, mature fowls may frequently be found harbouring coccidia in their alimentary canal without showing any ill effects. Such birds, however, may provide the infective material for a serious outbreak among chickens kept on the same property.

THE PARASITE AND ITS LIFE HISTORY.

When viewed under the microscope, the coccidia, in the state of development occurring in the droppings of infected birds, are found to be minute bodies, with an ovoid or round shape, and possessing a thick double shell. These egg-like structures are known as *Oöcysts*, which contain within their shell four small structures known as *sporozoites*. The *Oöcysts* possess a marked degree of resistance to adverse conditions.

Coccidiosis is spread by healthy birds taking in these *Oöcysts* with their food and water; that is, infected droppings with which fowl-runs have been contaminated are the means by which the disease is spread from bird to bird.

When the *Oöcysts* reach the intestinal tract, the *sporozoites* which they contain are liberated; the liberated *sporozoites* then penetrate and destroy the cells lining the mucous membrane of the gut. Each *sporozoite* entering a cell begins to multiply rapidly, and the progeny invade further cells so that, in an intense infestation, the destruction of the lining of the bowel becomes extensive. After a certain time, the quick division ceases, and the young coccidia become differentiated into male and female forms; the females are fertilized by the males, and the result of this sexual conjugation is the production of *Oöcysts*. The *Oöcysts* are cast off from the intestinal lining, are voided with the droppings, and the life history proceeds again in the birds swallowing the *Oöcysts*.

SYMPTOMS.

Chickens infected with Coccidiosis may present signs of infection from the tenth day onwards, although, as a general rule, the disease appears after the fourth week. The course is more rapid in very young chickens, with usually a high mortality. The main symptom shown is diarrhoea, with the passage of whitish fluid droppings, which may be streaked with blood. Infected birds become weakened and dejected, with drooping wings and ruffled feathers; the appetite is generally seriously impaired, or may be absent. Death takes place in a day or two after the appearance of symptoms, although older chickens may live for several days to a week or more before death ensues.

In grown fowls, the disease is usually more chronic, with the development of a progressive emaciation and anaemia. The appetite may remain normal, but in the intervals between regular feeding, they show no inclination to scratch for food. Affected birds may live for three weeks after the first signs of the disease are noted. Death frequently occurs quite suddenly.

POST-MORTEM FINDINGS.

The chief abnormality present consists of a distension of the blind gut or caeca with blood-streaked semi-solid material. Frequently, apart from an anaemic condition of the body, and a moderate distension of the caeca, no typical naked-eye characteristics can be found. It is necessary to stress the fact that it is generally impossible to make an accurate diagnosis without a microscopic examination of the contents or the lining membrane of the bowel. When very young chickens are attacked, it is necessary to make a differentiation between Coccidiosis and Pullorum disease; this is only possible by laboratory investigations.

METHODS OF TRANSMISSION.

The chief methods of extension of the disease may be tabulated as follows:—

1. From apparently healthy but mildly infected birds. The presence of birds harbouring coccidia in their bowel always constitutes a menace to growing chickens. The infective *Oöcysts*

present in the droppings may be carried on the boots and clothes of the attendant from the adult birds to the brooder houses and chicken runs.

2. Sparrows and other wild birds may carry the disease from place to place, either mechanically or through their own infected droppings.

3. Chickens may be reared in infected coops, or on ground previously contaminated by infected birds, or they may be transported in crates soiled with infected material.

4. It is sometimes difficult to explain an outbreak of Coccidiosis in very young chickens which have been hatched and reared in new equipment. Such outbreaks may be due to using eggs for hatching which have been laid by infected hens and soiled with droppings containing the *Oöcysts* of coccidia. When the chicken emerges, it picks up the infective material by pecking at the egg shell, becomes infected with Coccidiosis, and transmits the infection to the other chickens. The appearance of Coccidiosis as early as the tenth day after hatching may be explained in this way.

CONTROL.

Up to the present time, no effective medicinal treatment for Coccidiosis has been elaborated. The use of crude Catechu in the proportion of one-third of a teaspoonful to each gallon of drinking water has been recommended for a long time, mainly with the object of preventing the disease gaining a hold, but it is extremely doubtful if this drug has any value. A mash containing 40 per cent. of dried skim milk has been used as a preventive agent, apparently with some degree of success. From every practical point of view, however, prevention of the spread of the disease is the only sound method of control. Once the diagnosis of Coccidiosis is established, all sick birds should be destroyed and their carcasses, together with those of birds dying from the disease, burnt. Birds not showing symptoms, but in contact with diseased birds, should be immediately and satisfactorily isolated, and every care taken to prevent the distribution of infected droppings to other parts of the farm. The ideal procedure would be for one person to undertake the feeding and general management of the isolated stock, and to have nothing to do with the remainder of the poultry farm. Where this is impracticable, the isolated stock should be attended to last, and whoever undertakes this work should at its conclusion make sure that his hands, boots, &c., are carefully disinfected. All droppings should be removed well away from the precincts of the farm, where they should be burnt. The cleansing and disinfection of the houses should be thorough. In cases where the floors of the pens, houses, &c., are concrete, brick, or other non-inflammable material, the most efficient disinfection can be accomplished with a painter's blow-lamp. Failing this, the use of some well-known chemical disinfectant in the strength advised by the makers is recommended. Runs to which diseased birds have access are highly dangerous, and should be abandoned for at least a year. Where this is impossible, the soil should be treated with ground quicklime, and ploughed or dug under.

Poultry farmers should always seek the co-operation of the poultry experts of the Department of Agriculture in attempting any system of disease control.

REGISTRATION OF STALLIONS.

TENTH ANNUAL REPORT.

Horse Breeding Act 1928.*

By E. A. Kendall, B.V.Sc., Chief Veterinary Inspector.

The number of registrations of stallions effected under the *Horse Breeding Act 1928* during the year 1929-30 was 787. These comprised 557 draught, 134 light, and 96 pony stallions. Five hundred and sixty-four were registered without examination, having reached their sixth year, after previously passing inspection for registration at the ages of three to five years inclusive. Two hundred and twenty-three were submitted for examination, consisting of 183 draught, 24 light, and 16 pony stallions.

In the draught class 42, or 22.95 per cent., were rejected; unsoundness accounted for 22, or 12.02 per cent.; the other 20, or 10.93 per cent., were refused registration on the grounds of being below a reasonable standard for stud purposes. Of the 24 light stallions submitted 4, or 16.66 per cent., were disapproved as being below standard. There were no rejections for unsoundness. In the pony class of 16 stallions 1 was rejected for unsoundness, and 1 as being below standard.

When compared with the figures for the year 1928-29 it will be seen from the accompanying tables that the percentage of rejections for the year under review is considerably higher, the total being 21.52 per cent. as against 14.76 per cent. for the previous year. This is due to the larger number of draught stallions which were refused registration this year on the grounds of unsoundness and of low standard, the percentage being 12.02 and 10.93 respectively, compared with 5.47 per cent. and 7.46 per cent. for 1928-29.

Besides the increase by 5 over last year's figures in the number of stallions rejected in the draught class for disapproval, there is the unpleasant fact that whereas only 7 were rejected last year for sidebone, 19 were refused registration on that account this year, although 18 fewer were examined.

In last year's report attention was drawn to the marked reduction in the total percentage of rejections, which amounted to 14.76 compared with 20.43 per cent. for the year 1927-28, and to the difficulty in satisfactorily accounting for what appeared to be a material improvement in the soundness and quality of the stallions. It was further stated that it would be a matter of some interest to see whether such improvement was maintained during the year 1929-30. Reference to the tables in the following page shows that not only has the lower percentage of rejections shown last year not been maintained, but that it exceeds the figures of two years ago, particularly in respect of unsoundness.

This "slipping back" is considered to be largely due to want of care in choosing suitable mares for breeding purposes. The blame is almost wholly due to the foolishness of breeders; the stallion-owner can hardly be asked to share it, for any refusal of mares means a loss of stud fees. There is also the fact that some

* The Horse Breeding Acts of 1919 and 1925 were consolidated last year.

districts, particularly the more recently settled areas where farm horses are extensively employed, are badly off for stallions. There is consequently a tendency to keep colt foals, got in a haphazard way from weedy and unsound mares, uncastrated, in the hope that they may pass for registration, and so help to take the place of good sound stallions which are badly needed in these districts.

The shortage of suitable stallions for begetting good farm horses undoubtedly exists, as evidenced by the drop in the number of the younger draught stallions submitted for examination from 201 to 183, and the registrations from 175 to 141.

Reports from owners required under the Horse Breeding Act show that an appreciable number of young stallions and a few older ones previously registered have been castrated on account of the severe drought conditions which have prevailed in certain parts of the State for two or three years past, and which have made the keeping and travelling of a stallion unpayable.

It is almost certain that when normal seasons return there will be a serious shortage of heavy horses for farming operations. This shortage will also be felt by those firms requiring the same type of animal for haulage in the industrial centres. It is therefore likely that prices for sound young weighty draught horses will advance considerably in the next few years. Inasmuch as it takes at least four years to produce a horse fit for work, the time would appear to be overdue when those engaged in breeding horses and those who must use them should be making provision to meet the shortage which seems likely to continue for some years, and which may perhaps become more acute than at present. There seems little cause for fear that it may not pay to breed utility horses of the draught type, provided the right sorts are bred to meet the requirements of buyers.

Summary of Examinations.

1929-30.

	Draught.		Light.		Pony.		Total.	
	Ex- amined.	Certifi- cated.	Ex- amined.	Certifi- cated.	Ex- amined.	Certifi- cated.	Ex- amined.	Certifi- cated.
	183	141	24	20	16	14	223	175
	Rejected.	Per cent. Rejected.	Rejected.	Per cent. Rejected.	Rejected.	Per cent. Rejected.	Rejected.	Per cent. Rejected.
Bog Spavin ..	..	..	..	..	..	..	..	..
Pone Spavin ..	..	..	..	..	..	..	..	..
Cataract ..	..	..	..	..	..	..	..	..
Curb ..	..	..	..	..	1	6.25	1	45
Osteo Porosis ..	..	..	..	..	..	..	..	..
Ringbone ..	2	1.09	..	..	..	..	2	89
Roaring ..	..	..	..	..	..	..	..	..
Shivering ..	..	..	..	..	..	..	..	..
Sidebone ..	19	10.38	..	..	..	..	19	8.52
Stringhalt ..	1	.55	..	..	..	..	1	.45
Through un- soundness ..	22	12.62	..	..	1	6.25	23	10.31
Through disap- proval ..	20	10.93	4	16.66	1	6.25	25	11.21
Total ..	42	22.95	4	16.66	2	12.50	48	21.52

Summary of Examinations.

1928-29.

	Draught.		Light.		Pony.		Total.	
	Ex- amined.	Certifi- cated.	Ex- amined.	Certifi- cated.	Ex- amined.	Certifi- cated.	Ex- amined.	Certifi- cated.
	201	175	23	16	13	11	237	202
	Rejected.	Per cent. Rejected.	Rejected.	Per cent. Rejected.	Rejected.	Per cent. Rejected.	Rejected.	Per cent. Rejected.
Bog Spavin ..	1	·497	1	4·347	..	..	2	·844
Bone Spavin ..	1	·497	..	..	..	..	1	·422
Cataract ..	..	..	..	..	..	..	..	..
Curb ..	..	..	..	..	..	..	..	..
Osteo Porosis ..	1	·497	..	..	..	..	2	·844
Ringbone ..	1	·497	1	4·347	..	..	..	..
Roaring ..	..	..	..	..	..	..	1	·422
Shivering ..	1	·497	..	..	..	..	1	·422
Sidebone ..	7	3·482	..	..	..	..	7	2·953
Stringhalt ..	..	..	..	..	..	..	..	..
Through un- soundness ..	11	5·470	2	8·694	..	..	13	5·485
Through disap- proval ..	15	7·463	5	21·739	2	15·384	22	9·282
Total ..	26	12·933	7	30·433	2	15·384	35	14·767

APPEALS.

There were no appeals lodged against the decisions of the veterinary officers who carried out the inspection of stallions during the year.

COMPENSATION FOR STALLIONS REJECTED.

Fourteen claims for compensation were lodged during the current year under the Horse Breeding Act in respect of stallions which, having been registered last year, were rejected at this year's inspection for unsoundness and subsequently castrated.

Parades for the Coming Season.

Owners of stallions are advised to study the schedule of parades which will be published in the next issue of the *Journal*, and select the centre that will be most convenient to them. Application should then be made on or before the 1st July, 1930, on the prescribed form for registration. Owners are reminded that, under the *Horse Breeding Act* 1928, it is now compulsory to forward with each application the sum of £3, being £1 registration fee and £2 compensation fee.

Veterinary officers will not necessarily attend any place specified in the schedule unless a notification is received that a stallion will be presented there for examination on the date and hour fixed in the schedule.

Forms of application may be obtained from secretaries of Agricultural Societies and from officers in charge of police stations, for whose assistance in this connexion the thanks of this Department are due.

Owners of stallions must bear in mind that change of ownership should be notified without delay in order that the certificate of registration can be suitably endorsed. A registration expires within 30 days unless the required notice is given.

F.A.Q. WHEAT, 1930.

Analysis of Sample.

A portion of the f.a.q. wheat sample for 1930 has been analyzed in the departmental laboratory and milled in the experimental flour mill. The sample shows in some respects an improvement on that for 1929. The percentage of screenings or material not suitable for milling is 2.7, as against 3.5 last year, and consists mainly of badly broken grain, with weed seeds, including saffron thistle, black oats, and rape. The protein content, 10.87 per cent., shows a slight increase on last year's figure. The analytical results for 1930 and those of the three previous years are given below:—

	1927.	1928.	1929.	1930.
	%	%	%	%
Moisture	9.47	9.41	9.20	10.58
Impurities (screenings)	3.36	2.54	3.48	2.70
Ash	1.36	1.47	1.26	1.33
Nitrogen	1.63	2.04	1.77	1.99
Protein (N x 5.7)	9.28	11.63	10.11	10.87

The flour yield is slightly higher than usual, although some difficulty was experienced in obtaining a clean bran. The strength of the flour, as measured by loaf volume, shows a decided improvement over that of the 1929 sample, although protein and gluten figures are not markedly different. The water absorption capacity is considerably lower than has been the case for the past two years. The colour of the bread was yellowish and very poor. Analysis of the flour gave the following results:—

	1927.	1928.	1929.	1930.
	%	%	%	%
Flour—Yield	69.5	70.0	70.4	73.2
Ash	0.53	0.48	0.41	0.49
Nitrogen	1.45	1.78	1.61	1.69
Protein (N x 5.7)	8.26	10.11	9.20	9.54
Wet Gluten	23.56	31.28	25.82	26.40
Dry Gluten	7.93	10.44	8.54	8.57
Water absorption (qts.)	40.2	45.0	45.2	41.0
Standard Loaf Volume (c.c.)	1580	1680	1525	1610

The results of analysis of pollard and bran obtained during milling are set out below:—

	1927.	1928.	1929.	1930.
	%	%	%	%
Pollard—Ash	2.29	3.26	2.52	2.47
Nitrogen	2.28	2.80	2.37	2.42
Protein (N x 6.25)	14.25	17.50	14.83	15.09
Bran—Ash	3.76	3.68	3.67	3.55
Nitrogen	2.02	2.52	2.16	2.45
Protein (N x 6.25)	12.60	15.77	13.52	15.31

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Pomologist.

The Orchard.

CULTIVATION.

Cultivation work should be well on the way by this time. The ploughing should be advanced, so as to leave plenty of time for other orchard work. Autumn ploughing may be rough, but care should be taken to plough to the trees, so that a drainage furrow is left between the rows.

MANURING.

It is just possible, where heavy crops have been carried, that a top dressing of stable manure will be required to add humus to the soil. The fertility of the soil must be maintained; and, although stable and chemical manures as a general rule are of undoubted value as tree stimulants, well-cultivated and thoroughly tilled land will always carry fair crops with far less manure. Further, if the orchard land is well drained, cultivated, and sub-soiled, any manures that are used will be far more beneficial to the trees. The more suitable the conditions that are given to the trees, the better they can appreciate and assimilate their food.

Perhaps the most useful and valuable of manures is stable manure. It is of great use, not only as a manure and as an introducer of necessary bacteria into the soil, but its value in adding humus to the soil is incalculable. Organic matter, such as stable manure, introduced into the soil quickly becomes humus; this greatly ameliorates and improves soil conditions. It is impossible to say what quantity of stable manure is necessary per acre; that can be determined only by circumstances. Orchards in different climates and varying soils will require differing quantities. A too liberal use of stable manure will be over-stimulating in most cases, and at all times an excess beyond what is necessary for present use will only be waste, as humus is readily lost from the soil, once it is in an available food form.

It has been pointed out in these notes previously that an improved physical condition is far more profitable to the fruit-grower than the continued use of manures. A tree will be far more productive if it is happy in its soil conditions; uncomfortable conditions will always result in unprosperous trees.

A dressing of lime, using about 4 or 5 cwt. per acre, is of great value in stiff or heavy orchard lands; and it may be given at this season. The lime, which must be fresh, should be distributed in small heaps between the trees, covered with a layer of soil, and allowed to remain for a few days before ploughing or harrowing in.

PESTS.

The advice given last month for spraying should be followed, particularly where any oil emulsions or washes are to be used.

Orchards will benefit if an attack is now made upon the Codlin moth. All hiding places, nooks, and crannies, where the larvæ have hidden, should be thoroughly searched and cleaned out. The orchardist has far more time now to do this work than he will have in the spring time.

GENERAL WORK.

Drainage systems should now be extended with as little loss of time as possible.

New planting areas should be prepared and sub-soiled or trenched wherever possible.

The Vegetable Garden.

Weeds must be kept down in the vegetable garden. Weeds are generally free growing at this season; their growth is very insidious, and they will crowd out the young seedlings or plants in a very quick time. Hoeing and hand weeding must be resorted to, preferably hoeing. The frequent use of the hoe in winter time is of much benefit in the vegetable garden. A varied assortment of crops is now being produced; and if these can be kept growing much better crops will result. The soil quickly stagnates in the winter, and the only way to prevent this is to keep the surface stirred. Thus, a double service is performed with the aid of the hoe.

The application of lime is of great necessity at this season. In addition to amending unhealthy and unsuitable soil conditions, lime is particularly useful as an insecticide. It assists in destroying in immense numbers both eggs and insects that would breed and live in the ground ready to do damage to all classes of vegetable crops. Therefore, wherever possible, the soil should receive an application of lime. The garden should, as well, be manured with stable manure, but not for some weeks after the lime application.

Cabbage and cauliflower plants may be planted out; and seeds of parsnips, carrots, onions, peas, and broad beans may be sown.

The Flower Garden.

The whole flower section should now be thoroughly dug over. All beds should be cleaned up, top dressed with manure, and well dug. The light rubbish, such as foliage, twiggy growths, weeds, &c., may all be

dug in, and they will thus form a useful addition to the soil. These should never be wasted. Only the coarser and stouter growths should be carted away for burning, and then the ashes may be used as manure. No part, whatever, of garden rubbish or litter need be wasted. In one form or another it should be replaced in the soil.

May is a good month for establishing new gardens, and for planting out. All deciduous plants and shrubs may now be planted. It is not necessary to dig a deep hole for planting. A hole in which the roots of the plant can be comfortably arranged, without crowding or cramping, will be quite sufficient for the purpose, the soil around being very well cultivated.

Continue to sow seeds of hardy annuals, including sweet peas, although the main crop of sweet peas should by this time be well above ground. Where there has been any overplanting, the young plants will readily stand transplanting, and this will greatly assist those that are to remain. Annuals should not be crowded in the beds. They require ample room for suitable development, and thus the seeds should be sown thinly or the plants set out at good distance from each other.

All herbaceous perennials that have finished blooming may now be cut down. Included amongst these are phlox, delphiniums, &c. If these are to remain in their present situation for another season it is always an advantage to raise them somewhat, by slightly lifting them with a fork, so that too much water will not settle around the crowns; they may also be mulched with stable manure, or the manure may be forked into the soil around the crowns.

REMINDERS FOR JUNE.

LIVE STOCK.

HORSES.—Those stabled and in regular work should be fed liberally. Those doing fast or heavy work should be clipped; if not wholly, then trace high. Those not rugged on coming into the stable at night should be wiped down and in half-an-hour's time rugged or covered with bags until the coat is dry. Old horses and weaned foals should be given crushed oats. Grass-fed working horses should be given hay or straw, if there is no old grass, to counteract the purging effects of the young growth. Old and badly-conditioned horses should be given some boiled barley. Paddocked horses should be looked at from time to time to ascertain if they are doing satisfactorily.

CATTLE.—The maize crop should now be safe in the silo, and available to help in meeting the increasing feeding needs. The food-maintenance costs can be economized on considerably by giving the milking cows the advantage of either shelter or rugs. Rugs should be removed and aired on any sunny day, or when the temperature exceeds about 60 degrees. Use should now be made of the oat or other cereal crop, over 6 inches high, by grazing, if soil will stand it. Don't let cows remain on the crop after their appetites have been once satisfied. If soil "pugs," with tramping, it will be better to cut the green material and throw it over the fence to the animals. Try to keep the crop down below 9 inches; it is better for the crop itself and better for the cows. Under winter conditions, it is better that cold and watery fodder be somewhat limited, and the difference made up with some drier food, such as hay or chaff. Meet any falling yields that

are due to the seasonal combination of checked growth and increased appetite, with hand-feed designed both to amplify and balance the paddock supply. Watch the falling yields and test out the efficacy of concentrate to profitably check them. Take warning at cows (either milking or dry) losing condition and feed them better. Keep the main herd away from the bull for a month longer, and serve only cows wanted for early autumn milking. Feed the bull well with balanced material to fit him for his coming heavy work. See that the calves have a grass paddock in which to exercise, a wind-break for shelter, and a well-drained spot, as dry as possible, on which to lie. Look to condition of yards and drainage, so that yards may be kept reasonably sanitary. Don't be tempted by cool weather to keep cream on farm over long; stale cream is never good cream.

PIGS.—Supply plenty of bedding in well-ventilated sties. Sows in fine weather should be given grass or lucerne run, and kept in good forward show condition. Bulletin on the Pig Industry is now available.

SHEEP.—As June is the month in which the bulk of the lambs are dropped in Victoria, careful attention should be given to all flocks of lambing ewes. Two- and four-teeth ewes, particularly merino and fine-woolled crosses lambing to English rams, often have trouble. During the peak period of lambing, the flock-owner should visit the paddock at least three times a day (early in the morning, midday for any special cases, and late evening are the best times), so that aid may be given to any young ewes that are having abnormal difficulty in parturition. It is not wise, of course, to disturb the flock unnecessarily at this stage, and some sheep dogs should not be allowed to accompany the flock-master on his daily rounds.

It may be found advisable to induce the young ewe to take to her lamb immediately after birth; to help in this a small enclosure of wooden hurdles should be placed in a convenient place; the ewe, with her lamb, should be put therein for a few hours; the result will usually prove worth the trouble.

Mark ram lambs as soon as possible; this can be done any time after a week from date of dropping, until all the ewes have lambed; they can be marked in batches as they become a few weeks old. A plan of temporary marking yard is included in this issue. A good idea is to construct temporary yards in the paddock made with stakes, wire-netting, and a few hurdles, so that the marked lambs can be dropped on to clean pasture.

Flocks of dry sheep should be attended to regularly, and, if necessary, crutched, the wool removed from around the eyes, hoofs pared, and treatment administered in case of worms, or flies, or foot-rot. Hoofs can be pared easily during the winter months; it should be remembered that overgrown hoofs are conducive to lameness, and even to foot-rot.

Stud sheep intended for exhibition should be given special feed from now on, and their wool looked to for general protection.

Foxes are more ravenous during the winter months. Sparrows, starlings, and parrots are good bait. Poisoning the carcasses of lambs usually accounts for scavenger foxes only. Powdered strychnine just sufficient to cover a three-penny piece is the usual dose to apply to a bait.

POULTRY.—Supplies of shell grit and charcoal should always be available. Sow a mixture of English grass and clover; this not only removes taint in soil but provides excellent green fodder for stock. Where possible, lucerne and silver beet should now be sown for summer feed; liver (cooked) and maize aids to egg production during cold weather. Morning mash should be mixed with liver soup given to the birds warm in a crumbly condition. All yards should be drained to ensure comfort for the birds.

CULTIVATION.

FARM.—Plough potato land. Land to be sown later on with potatoes, mangolds, maize, and millet may be dressed with stable manure and well worked. Sow malting barley and sow cereals. Lift and store mangolds, turnips, &c. Clean out drains and water furrows. Clean up and stack manure in heaps protected from the weather.

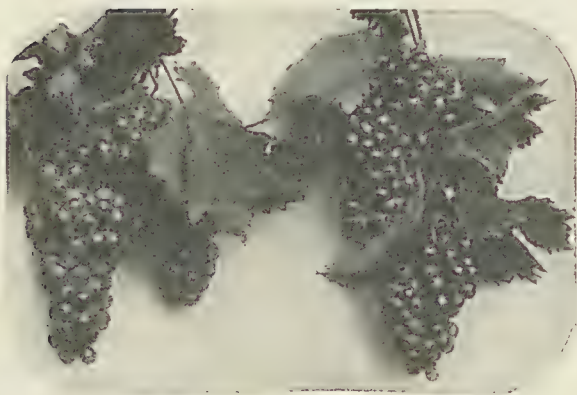
ORCHARD.—Finish ploughing; plant young trees; spray with red oil or petroleum for scales, mites, aphids, &c.; carry out drainage system; clean out drains; commence pruning.

VEGETABLE GARDEN.—Prepare beds for crops; cultivate deeply; practise rotation in planting out; renovate asparagus beds; plant out all seedlings; sow radish, peas, broad beans, leeks, spinach, lettuce, carrot, &c.; plant rhubarb.

FLOWER GARDEN.—Continue digging and manuring; dig all weeds and leafy growths; plant out shrubs, roses, &c.; plant rose cuttings; prune deciduous trees and shrubs; sow sweet pea and plant out seedlings.

VINEYARD.—Thoroughly prepare for plantation, land already sub-soiled for the purpose. Remember that the freer it is kept from weeds from this forward, the less trouble will there be from cut-worms next spring. Applications for grafted resistant rootlings and cuttings must be made before the end of the month—see current issue. Pruning and ploughing should be actively proceeded with. In northern districts plough to a depth of seven or eight inches as early in winter as practicable. Manures should be applied as early as possible.

Cellar.—Rack all wines which have not been previously dealt with. Fortify sweet wines to full strength.



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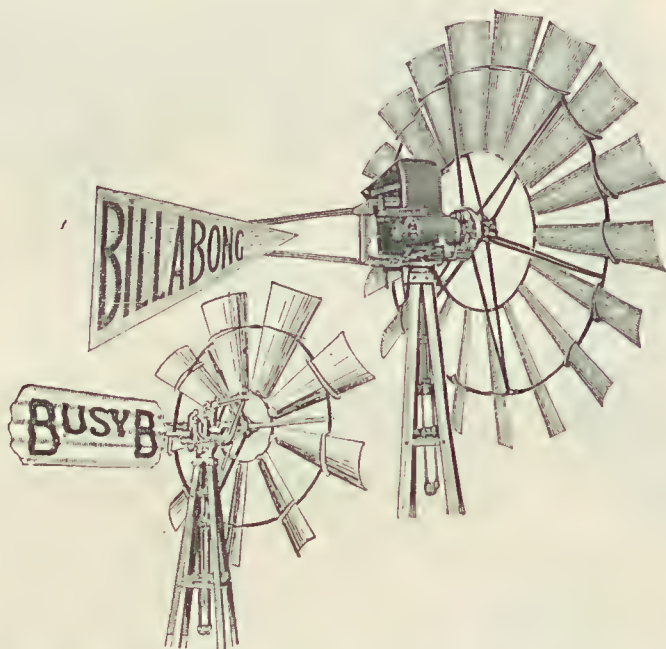
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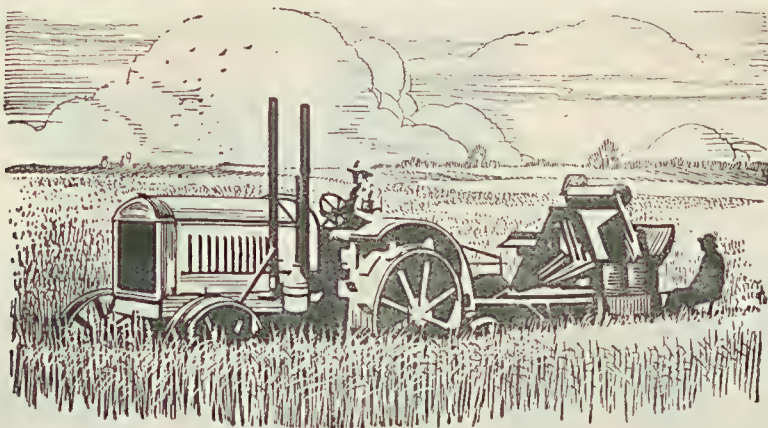
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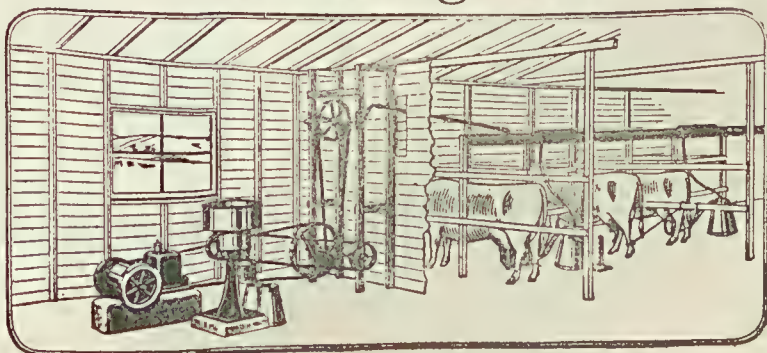
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